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[Original Communication.]

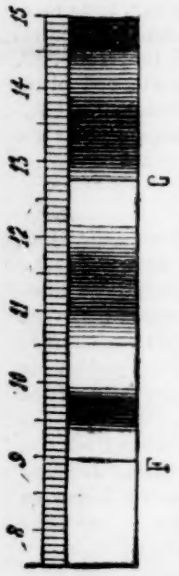
Fluorescent Relations of Certain Solid Hydrocarbons Found in Petroleum Distillates.

[By HENRY MORTON, Ph. D., President of the Stevens Institute of Technology.]

[Continued from page 147.]

If now we observe the absorptive action of these solutions in the manner indicated in fig. 3, we shall find that the absorption bands, like those of fluorescence, are displaced upwards in the spectra of the solutions, as compared with their position in that of the solid. This will be illustrated by comparing fig. 9, which represents the absorption spectrum of thallene dissolved in benzole, with fig 6, which is the absorption spectrum of solid thallene.

FIG. 9.



The absorption bands of the solutions in benzole, chloroform, and olive oil, do not appear to differ in any important degree, but in the ethereal solution the bands are higher than in the others, while in the solution in turpentine the lower band especially is exceedingly faint, so as to escape recognition entirely, in the method of observation employed in the other cases, even when a pint bottle of solution was used. But when the tube of a Duboscq saccharimeter was filled with this solution, this line could be detected with a small direct vision spectroscope.

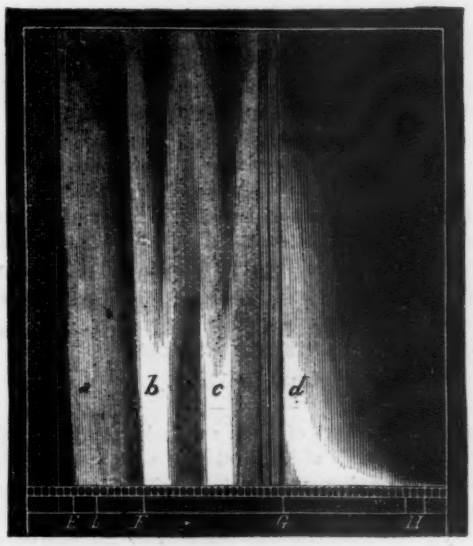
In carbon bisulphide solution a similar difficulty was encountered, so that in a preliminary publication I spoke of these bands as not appearing, but renewed observation has enabled me to assure myself that in this solution all the bands exist, and at lower points in the spectrum than in any of the other solutions yet examined, the lowest one in particular occupying a point even below that of the corresponding band in solid thallene. There is also in this solution a decided general absorption of all rays above F, which causes some special difficulty in measuring the bands.

A similar displacement of bands, by change of solvent, has been noticed by Hagenbach in the case of soot, amide of phtalic acid, chlorophyl, purpurin, etc. (Poggendorff's Annalen 1872, vol. 140, p. 533), and I have also found it in a number of the uranium salts.

In such cases as this the mode of observation to be next noticed is specially efficient as a guide, indicating what we must look for in each case.

When a pure spectrum is thrown on the side of a tank of glass or quartz filled with the benzole solution by the arrangement of prism—indicated in fig. 4—we see, on looking down into it from above, long trails of light running through the solution. as shown in fig. 10

FIG. 10.



These trails are variously colored as follows: *a* is very faint and olive green, *b* is very bright and of a vivid green, *c* is bright sky blue, and *d* is of an indigo tint running into violet towards H. The appearance is indeed exceedingly beautiful from the richness of the colors, and the delicate manner in which they fade off and blend.

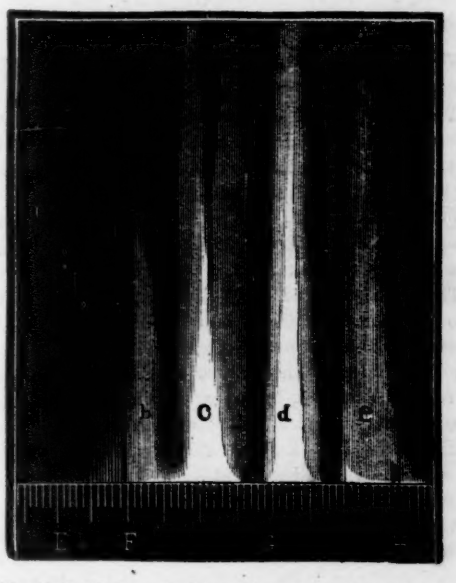
The brightest bands or trails, *b* and *c*, are each penetrated, as it were, from the further side of the tank, by a long blade of darkness, the result undoubtedly of the absorptive action of the fluid for the corresponding rays, which causes them to be most rapidly exhausted, while those at either side being less energetically active and acted upon, penetrate further before their motion is converted into fluorescence. Near H, where the actions of absorption and fluorescence are most intense, the light hardly seems to pass beyond the actual surface of the liquid.

Exact parallels to all these actions were observed by Stokes in Chlorophyl.—*Phil. Trans.* 1852, part II, page 489—but though I have examined all the substances enumerated by him, I have in no case found so beautiful an exhibition of the phenomena as this solution furnishes.

When the light from these trails is examined with a hand spectroscope, it is seen that the bright green one *b* wants the upper blue band 10.7, which is present in *c* and *d*. This was a necessary result from Stokes's law, that fluorescent light never contained rays of higher refrangibility than that by which it was excited, for the exciting light of *b* was only a little above F, or 9. to 9.5 of the scale.

Turpentine dissolves only a small portion of thallene, which, however, communicates to it a bright, blue fluorescence. When examined in the manner just described, its appearance resembles in many respects that of a similarly weak solution in benzole; but there are certain points of distinction. Thus, the first band above F is at some distance from it, the second band is decidedly double, with its upper half of a paler color, and the band above G is likewise evidently divided. See fig. 11.

FIG. 11.



The dark blades of absorption are not seen in this, or in a dilute benzole solution. A solution of thallene in carbon-bisulphide having, (as we have seen) its absorption bands very low in the spectrum, produces also in this last method of examination a very characteristic appearance.

The first trail of light is entirely below F, and is piereed by a dark blade; its color is bright green. The next is midway between F and G; is bright blue, but does not penetrate very far into the solution, and does not show a black blade. The upper trail is of a faint indigo tint, penetrates but little into the liquid, and begins decidedly below G.

In a former paper, attention was drawn to the effect which an exposure to sunlight produced upon the bands of absorption exhibited by commercial anthracene. A cold solution of that substance, showing its bands with great distinctness, loses them entirely by an exposure of ten minutes to the direct rays of the sun. Thallene similarly treated loses its lower band

in five minutes, but its upper one (*i. e.* the broad double band) only after thirty minutes exposure.

A saturated hot solution under like conditions, loses its lower band in thirty minutes, and its upper one in about two hours. By placing it, however, near the focus of a large burning glass of fifteen inches diameter, ten minutes sufficed for the effect. When a solution of white anthracene, so exposed for one minute, is allowed to cool, it deposits white pearly scales (of pure anthracene) which show no trace of a banded spectrum by fluorescence.

When a solution of the yellow anthracene (obtained by washing the crude material with benzine, dissolving in hot benzole filtering, and crystallizing by cooling) which contains much chrysogen, is similarly treated, after ten minutes exposure in the focus of the lens, it deposits on cooling, crystals of anthracene, nearly white, but still showing a banded spectrum. The bands are weaker than before, but occupy exactly the same positions. The general fluorescence of the substance is also greatly reduced.

Thallene, however, under similar conditions—that is to say exposed in hot solution in a four ounce flask, for ten minutes, near the focus of the large lens, and allowed to cool, deposits crystals almost white, but having a slight gray shade, and these show a distinctly banded spectrum, whose bands are located in almost the same positions as those of an ethereal solution, but are a little more elevated. Their centers are in fact located as follows: 7.34, 9.13, 11.17, omitting the lowest band, which is too broad to be well indicated in this way.

The general color of the fluorescent light emitted by this substance is light blue, and to distinguish it I would propose the name Petrollucene. A solution of this in benzole shows a slight further elevation of bands as 7.38, 9.2 and 11.24, and when a pure spectrum is thrown on this solution, only two trails of light are seen, one about four-fifths of the way from F to G, and the other above G. These are blue and indigo respectively in color.

EFFECTS OF HEAT ON BANDS OF SOLID AND SOLUTION, AND ON FLUORESCENCE.

The very marked displacement of fluorescent and absorptive bands which I had observed in some of the salts of uranium, led me to examine thallene in a similar way, but though the temperature was pushed in the case of the solid to the point of decomposition, no other effect was observed than a loss of fluorescence at a high temperature.

The same is true of the solution in benzole, which also like the organic bodies observed by Stokes, showed no loss of fluorescence when heated to moderate temperatures (such as 100° C.). Solution of the nitrate of uranium, however, as he also observes, loses its fluorescence far below 100° C. And I have found this observation to extend to all the uranium salts, such as certain acetates, sulphates, and phosphates, whose solutions fluoresce.

Anthracene forms, as is well known, a compound with chlorine—bichlor-anthracene whose solutions in alcohol and benzole fluoresce brightly and give a spectrum, banded in the upper regions, which has been studied by Hagenbach. (*Poggendorff's Annalen*, vol. 146, p. 385.)

This led me to attempt the preparation of a like compound with thallene. A quantity of bi-chloranthracene having been first made, to insure accuracy in the method of working, thallene was submitted to the same treatment, that is, was mixed with benzole and subjected to a current of chlorine for about one hour. A strong reaction was shown, considerable heat being developed, and the entire substance acquiring a chocolate color. The product, however, showed no tendency to crystallize, and indeed, in all respects, resembled the description which is given of trichloranthracene. In its tarry state and in solution its fluorescence was moderately strong, and gave a spectrum from about C to E without bands.

Having next prepared some bi-brom anthrecene and examined its fluorescence, I submitted thallene to an identical treatment, but here also, though a compound was formed crystallizing in very minute needles from its hot benzole solution. neither the solid nor solution showed any indications of fluorescence.

I found, moreover, that while anthracene combines with about twice its weight of picric-acid, to form the picrate which crystallizes in long needles of a rich strawberry color, thallene requires fully four times its weight of picric acid to saturate it. On cooling from hot solution a granular mass of minute crystals is formed, having a rich orange red color. Examined under the microscope these crystals are seen to be short prisms, with well defined pyramidal terminations.

Sulphuric acid of density 60° B., which rapidly blackens anthracene even at the ordinary temperatnre, gives thallene a rich grass green color, which remains unchanged, even after standing for weeks, and exposure to a temperature of 60° C.

In this condition it continues to give a bright fluorescence, yielding a banded spectrum, identical with that characterizing it in its normal state. I should therefore conclude that no true combination had occurred, and that the change from a yellow to green color resulted from the presence of minute black particles, produced by the action of the sulphuric acid upon some small portion of an adherent impurity. This view is confirmed by the fact that to petrollucene which is almost colorless, sulphuric acid gives a dark green color, approaching black. Continued application of heat causes thallene treated as above to dissolve, forming a compound perfectly soluble in water.

The picric-acid compounds both of anthracene and thallene show no fluorescence, so that this gives us a convenient method of determining the point of saturation.

A little solid thallene placed between slips of mica in Becquerel's phosphoriscope, showed a bright illumination, with a rate of rotation corresponding to a duration of about 1-500th of a second for the fluorescent action, but the benzole solution showed no illumination at the highest velocity to which the apparatus could be urged.

Coal in Italy.

A correspondent of *Iron* says a discovery has recently been made which, in the present state of the coal question, has an importance which justifies special notice. Lignite has been abundantly found in many parts of Italy, but no true coal had hitherto been known to exist. In recent correspondence a notice of the probability of such fuel being found in Calabria was given, but no true seam, if such exists, has been actually discovered. But at a place called Sasso Forte, near Grosselo, in Tuscany, coal of admirable quality has been actually worked, in a bed of 25 feet thick cropping out at the surface. A considerable quantity has been used in a locomotive of the Roman Railway, which runs at Rocca Strada Railway station, within eleven miles of the coal. The result was equal to English steam coal, and on their engineer's report, the directors of the railway have expressed their willingness to take a considerable quantity per day, so soon as they can be delivered. There is a remarkable mountain of trachytic rock called "*sassoforte*," visible for miles around, which seems to have contributed at the time of its upheaval to bring the lower carboniferous strata to the surface at this point, and the character of the coal, as well as the thickness of the seam and the surrounding rock, forbid the supposition that it is in any way related to the lignite beds which are found and worked in the Macomma, not far distant. Within three miles by rail there is the seaport of Follonica, so that the coal from these deposits of valuable fuel will easily reach any of the Mediterranean markets. Thus one of the demands on English coal resources may be stopped without resorting to the extreme measure of an export duty on coal. This might, after all, affect unfavorably our own steam navigation interests quite as much as the foreign consumer. We cannot but rejoice at the prospect of the consequent development of Italian industry in a manner which must tend to lower the prices of many articles produced in that country which find their principal market in England.

Chemical Repertory.

No. 92.—May 16, 1873.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

723.—Coal in Russia.—A correspondent of the London, England, *Morning Post*, gives the following very interesting account of the resources of Russia:

The chief centers of the Russian coal supply are as follows:

In the south, the basis of the Lower Don, which of itself contains 16,000 square miles of the finest anthracite; in the west, the governments of Kiev and Khaokiff, which are daily attracting fresh explorers, and adding almost monthly to the list of new discoveries; and further to the north, the great central, or Moscow basins, comprising the governments of Tver, Kalouga, Moscow, Riazan, Tula and Novgorod, and extending northward as far as the Dwina. The official estimates made in December, 1871—since which time many rich beds have been discovered—rate the supply as follows:

Basin of the Lower Don, 15,000,000,000 poods (the pood being 36 lbs. English); government coal fields of Poland, 516,000,000 poods; Moscow basin, 15,000,000,000 poods; Kiev government, 80 miles of superficies by 21 feet of thickness (actual contents not specified.) To these items may be added those of the Kharkoff and Ekaterinoslaa beds of anthracite, the new strata which are being constantly discovered in the eastern provinces, and the private coal fields of the "Privis linski Krai"—the districts lying to the east of the Vistula.—*Iron Age.*

724. The Mount Diablo coal mines, near San Francisco, yield from 8,000 to 10,000 tons per month, for most of which there is a steady demand for steam purposes. From 300 to 350 men are continually engaged in the mines, and about fifty on the railroad or in shops on the upper deck, or about 400 in all. Miners are paid from $1 to $1.25 per yard for cutting coal, and can average 3.50 to $4 per day, some earning much more. Coal buckers and common laborers are paid $2.50 per day, drivers and timbermen, $3, engineers from $80 to $120 per month, and blacksmiths $100. The company is disbursing about $30,000 per month for labor, besides large amounts for lumber, machinery, and supplies in San Francisco.—*Iron Age.*

725. A Lecture on the Oil Regions.—Mr. H. G. Noble addressed the Polytechnic Association last evening upon the geology of the Pennsylvania oil region and the processes in use for procuring the oil. He first delineated the oil stratum and its relations to the different wells, showing why one well yields more oil than another adjacent. With the help of the blackboard he gave a minute description of the machinery for digging and pumping the oil and utilizing the escaping gases. A principal aim of the discourse was to show that the oil business was no longer an uncertainty. The problem now before oil merchants is, for what new purposes can oil be used? It makes the best gas, but the gas companies do not want cheap and good gas, but that which will meter well. Various plans were discussed for burning oil as a substitute for or in connection with coal.

726. Coal-Cutting Machinery.—Some new coal cutting machinery, worked by compressed air, has been successfully introduced into an English colliery, which it is estimated, if generally adopted, would require only 60,000 colliers to raise 120,000,000 tons of coal annually produced, instead of the 360,000 now employed.

Sir William Armstrong thinks one half the coal now used in manufacturing might be saved by greater economy. In steam-engines, at best, not more than one-tenth of the theoretic effect of the fuel was realized. In the Elswick Works his firm had erected two

Corliss engines (to do the work previously performed by ten smaller engines,) with boilers of the best construction, and one of these engines was now using 24 tons of coal per week, against sixty tons used by the engines it had superseded.—*Saward's Coal Trade Circular.*

727. Washing Coal.—Mr. E. Maximilian, of Sorbier, has patented some improvements in washing coal and minerals, which consist in charging the washing-table with a very thick layer of the coal, and in acting first on this layer by a stream of water ascensional only, in order to drive the fine particles into the upper layers, then in effecting the classification by order of density by a reciprocating movement given to the water, and progressively varying its effects by means of the direct action of steam or compressed air on the surface of the water.—*London Mining Journal.*

728. Miners' Safety Apparatus.—Capt. Denarouze has been recently exhibiting in the catacombs of Paris the effects of his safety apparatus for preserving life in an atmosphere of carbonic acid, or in an explosive mixture of fire damp and air. A miner carries on his back a knapsack which contains a supply of pure air; from this a tube is conveyed to the mouth, and the nostrils are closed by a spring; the same vessel is connected with a bright lamp fastened to the miner's chest. Both the man and his light are perfectly independent of the atmosphere in which he works. The knapsack being connected by a tube with a large reservoir of air, existence and light can be maintained for a long period in an asphyxiating or an explosive gas. Capt. Denarouze proposes to use his apparatus for diving purposes also.—*Athenæum.*

729. Cornish Pumping Engines.—The number of pumping-engines reported for January is 18. They have consumed 2,824 tons of coal, and lifted 21·8 million tons of water 10 fms. high. The average duty of the whole is, therefore, 52,400,000 lbs., lifted one foot high, by the consumption of 112 lbs. of coal. The following engines have exceeded the average duty:

Crenver and Wheal Abraham	—Sturt's 90 in	56·0
Ditto	—Pelly's 80 in	58·7
Ditto	—Williams's 70 in.	63·0
Dolcoath	—85 in	64.9
Great Work	—Leed's 60 in	63·8
West Basset	—Thomas's 60 in	58·0
West Chiverton	—Hawke's 80 in	52·5
Ditto	—New 80 in	61·7
West Wheal Seaton	—Harvey's 85 in	59·5

730. Lead Pipes and Frost.—A correspondent of the London *Builder*, makes what appears to be a very practical and useful suggestion, with reference to the prevention of the bursting of lead pipes by frost. He says:

"Let an ordinary lead pipe be passed through a pair of rollers so as to flatten it slightly; the expansion of water within it during frost will only tend to bring it to a circular shape, and, probably, it will require many severe frosts to accomplish that, for even in lead there is some elasticity. An iron (wrought iron) or zinc pipe would probably always resume its flattened shape, after the frost is over. Other sections, besides the elliptic, might, of course, be applied —as half round and three-quarter round, with a flat side to the wall. These sections for water or gas pipe would be far neater in appearance than the circular shape now universal."—*Am. Artizan.*

731. The Gases Produced on Dissolving Pig Iron.—On dissolving pig iron in muriatic or sulphuric acid no pure hydrogen is obtained, but it is always contaminated with various gaseous and liquid hydrocarbons of disagreeable odor. If these are conveyed through alcohol or concentrated oil of vitriol, an oil of noxious smell is absorbed, which separates again on diluting it with water. It was examined by Proust, Schroetter, Kastner, Schafhauetl, and recently again by Hahn. According to the latter, it is colorless when pure, lighter than water, very liquid and not congealing, at 20° C. Exposed to the air it grows yellow, common sulphuric acid decomposes it gradually, and fuming sulphuric acid immediately. It distills from 100° C. to 300° C., by leaving a thick fluid behind. The gaseous and liquid products which are generated so abundantly from white pig, belong especially to the ethylene series (C_{2n} H_{2n}) beside they contain peculiar bodies resembling the ethereal vegetable oils (C_{20} H_{16}). Resinified, they remain in the carbonaceous remnant on dissolving pig. There has also been discovered a substance similar to mercaptan.

732. Nicotine in Tobacco Smoke.—It has been claimed that there is no nicotine in the smoke of a cigar, and to test this assertion, Dr. Heubel passed a large quantity of smoke through water and alcohol, and then found that nicotine was positively present. Although nicotine is decomposed by heat, the salts are more stable, and it was in this form he found it. A portion, at least, of the effect produced by smoking, must be attributed to the action of nicotine, though, perhaps, still other substances act in connection with this poison.—*Am. Artisan.*

733. Petroleum.—Refined has assumed a rather firmer tone. About 5,000 barrels spot changed hands at 20f., in addition to which contracts have been lodged to an aggregate of 5,000 barrels May shipment at 20f., 2,000 barrels per September at 21½f., at which prices further sales would be feasible, also at 21½f. per last four months for large quantities, but no sellers at approaching rates are to be met with. Stock on hand in bonded store (Fyenoord) 20,492 barrels, on board *Nereus* 1,823 barrels, expected per *Venus* 4,500 barrels, total 26,815 barrels; against 1872 39,095 barrels 1,000 cases, 1871 23,606 barrels 1,000 cases, 1870 7,142 barrels 21,310 cases. Deliveries last week 4485 barrels.—*Trade Report in "Iron" from Rotterdam, March* 24, 1873.

734. On Aniline Blacks.—C. F. Brandt.—This paper treats at length on the modes of preparation, formation, and nature of the aniline blacks, which consist according to the author, of two distinct blacks mixed together in variable proportions. One of these, formed by the chlorated substitutes of aniline, is very fast, resisting almost all chemical reagents; but alone it is less beautiful than the other black, the product of the oxidation of the aniline salt. This substance really exhibits a deep violet-blue hue, which appears black in the concentrated state, but it is far less fast than the former; and although it resists soap, it becomes of a greenish color by even very weak acid. In order to obtain a beautiful as well as a fast black, it is necessary for the two blacks to be present in proper proportion, and this depends upon the proportion of chlorate contained in the mixture.—*Chem. News.*

735. Coal Gas for Illumination.—The improvements in the purification of coal gas used for illuminating purposes, and for mechanical purposes, and in apparatus therefor, invented by Mr. E. White, of New York, consists in methods and apparatus of purifying coal gas by friction and without the use of water. The gas is brought from the main into a vessel which divides its volume, and thence into a vessel containing tar, from which it passes through a series of pipes, up to the first pipe, and down the next, so on through the series, thence in a purified state to the gas main: each of the vertical pipes is provided with a scrubber and with a series of corrugated plates in the length of the pipe.—*Lond. Mining Jour.*

736. Coal-Cutting by Machinery.—"*Iron*" makes the following suggestions:

"English coal veins are usually from 2 ft. 4 in. to 2 ft. 10 in. thick, while the American bituminous coal veins are usually from 4 to 8 ft. thick, and the anthracite veins are from 20 to 50 ft. thick. This great disparity in the thickness of the veins is the reason why coal-cutting machinery has never been introduced into the American mines. There is little economy in employing cutting machinery in a 6 feet vein, while it greatly adds to the economical working of a 2 or 2½ ft. vein."

737. In Burning Corn as Fuel, it is claimed that the experience of western farmers has settled its cheapness, and it is thought will lead to its adoption to a great extent for that purpose. Six acres will annually yield enough corn for fuel for a family for one year, and the cost of raising it is less than would be the cost of coal or wood for the same time at present rates.—*Am. Artisan.*

738. Coal in California.—Other deposits of coal have been found in Contra Costa county, at different points on the proposed line of the narrow-gauge road Oakland to Contra Costa county. It has the appearance of being better than any other yet found upon this coast. It bears a general likeness to the English cannel coal.—*Mining and Scientific Press.*

739. Deposits of Fine Coal have been discovered in Lockhart county, Indiana, Russell county, Kansas, and near Butler, Bates county, on the line of the Kansas City and Memphis railroad. In the Nebraska legislature, it has been proposed to offer a reward of $50,000 to the finder of a four-feet vein of coal in that state.—*Am. Artisan.*

740. Croton Water.—Commissioner Van Nort, of the Department of Public Works, reports that the new storage reservoir at Boyd's Corners, Putnam County, holding nearly 4,000,000,000 gallons, is now full, an overflow of thirteen inches of water running over the washer-weir.

The Iron Age and the Gas Strikes.

The failure of the gas men to force the eight hour system upon the companies, by means of a strike, is a fact upon which employers in all trades can be congratulated. Its moral effect will be good, and the misfortune of the strikers, now out of employment, will tend to make the unionists in other trades more careful than they would otherwise be, to ascertain what lies on the other side of the fence before they undertake to jump it. The gasmen's strike was the first gun of the eight hour campaign, and since it has merely recoiled upon those who fired it, there is a very evident disposition among the workingmen in other trades to reconsider their determination to make demands upon their employers which they cannot safely undertake to sustain by giving notice of quitting work. From a careful investigation we are satisfied that there is no further danger of a general eight hour strike this spring. There is no important branch of mrnufacturing so prosperous at the present time in New York that a strike could be declared with any hope of success; and the means necessary to support themselves in idleness, that they will care to venture any doubtful experiments merely to try the temper of their masters. In the building trades especially, there is but little doing at the present time, and that little would be stopped as soon as a strike began in any branch. We have taken pains to ascertain from the most trustworthy sources of information the exact condition of the exact condition of the New York labor mnrket, and shall, in our next issue, give our readers the benefit of what we have learned.—*Iron Age.*

The abundance and cheapness of American petroleum have not seriously depressed the production of coal oil in Scotland. There are in that country sixty-eight oil works, which consume in the year 782,000 tons of shale or bituminous coal, and produce 21,840,000 gallons of oil for lamps, 5000 tons of paraffine, and 600 tons of sulphate of ammonia. Formerly the coal used yielded 120 gallons of crude oil to the ton, but the supply of that quality is exhausted, und shales are now worked which yield not more than from 15 to 35 gallons per ton.—*N. Y. World.*

Old King Coal.

Old King Coal was a merry old soul:
"I'll move the world," quoth he:
"My country's high, and rich and great,
But greater she shall be;"
And he called for the pick, and he called for the spade,
And he called for the miners bold:
"And it's dig," he said, "in the deep, deep earth,
You'll find my treasures better worth
Than mines of Indian gold."

Old King Coal was a merry old soul,
Yet not content was he:
And he said, "I've found what I desired,
Though 'tis but one of three,"
And for water he called, and he called for fire,
For smiths and workmen true.
"Come, build me engines great and strong,
We'll have," quoth he, "a change ere long:
We'll try what steam can do."

Old King Coal was a merry old soul:
"'Tis fairly done," quoth he,
When he saw the myriad wheels at work
O'er all the land and sea.
They spared the bones and strength of men,
They hammered, wove and spun;
There was naught too great, too mean or small;
The giant steam had power for all—
His task was never done.

Old King Coal was a merry old soul;
Quoth he, "We travel slow.
I should like to roam the wide world round
As fast as the wild winds blow."
And he called for skillful engineers,
And soon through hills and dales,
O'er rivers wide, through tunnels vast,
The flying trains like lightning passed,
On the ribs of the mighty rails.

Old King Coal is a merry old soul;
A merry old soul is he:
May he never fail in the land we love,
Who has made us great and free.
While his miners mine and his engines work,
Throughout all our happy land,
We shall flourish fair in the morning light.
And our name, and our fame, and our might and our right,
In the front of the world shall stand.

—*Iron Age.*

Chemical and Sanitary Report upon the Passaic River.

By Prof. Henry Wurtz.

To the President and Commissioners of the Board of Public Works, of Jersey City.

Hoboken, March 1st., 1873.

Gentlemen: Having been charged by your Honorable Board, with the arduous and responsible task of a scientific investigation of the waters of the Passaic, as supplied to your own and other rapidly growing cities on this side the Hudson, with a view to determine the sanitary questions that have arisen regarding the contamination of the same by sewage and drainage, and other possible causes; the undersigned has for nearly five months given to this investigation all the time, care, and diligence within his power.

It may be of value to state that all the analytical results herein reported were obtained by the personal labor of the undersigned, without co-operation of any kind; and, moreover, that as he is, with his family, resident within the district supplied by your water works, a personal interest in the questions involved may well be conceded. An anxious realization has also weighed upon him of the responsibility of the undertaking. All bias has been cast aside that may have pre-existed, founded on previous opinions or authorities; and though authorities will probably be cited in this report, the endeavor has been, in the actual work, to rely on individual experiment, to the rejection of preconceived opinions, either of himself or of other chemists.* The direct opinions sought for have been

Science being far removed from omniscience, and human power equally far from infallibility, the following observations and conclusions are not presented as free from error. They are but the best that were attainable within the time, and with the means and labor devoted; this time having, however, been extended, and this labor excessive and exhausting, if not altogether exhaustive.

Henry Wurtz.

Collection of the Samples for Analysis.

At the outset of the investigation, and on his first visit to your pumping works at Belleville, your reporter recognized a source of contamination to the stream which has hitherto been strangely overlooked. It seems incredible that it should be pointed out for the first time here; but, in a sanitary view it clearly involves the most important questions connected with this stream, and its relations to the rapidly increasing town populations that look thereto, for their supply of a necessary of life.

The source of contamination referred to is the flow into your pumps, during rising tides at least, of water which must have received the drainage of the populous city of Newark.

Samples were therefore so collected at Belleville as to enable this new question—regarded as the most important one that has arisen—to be tested analytically; namely, by taking the water at extreme high tide, to represent the maximum of contamination from Newark; as well as at extreme low tide, to represent water contaminated only with matters brought down by the river itself and its affluents above Belleville. An additional sample was taken from the receiving reservoir, which must represent a mixture of the alternate flows, up stream and down, at least so far as the "mineral" constituents of the water are concerned, though not necessarily representing those alterable "organic" ingredients which are, by many, deemed in a sanitary view of more real importance.

It providentially happened that it was possible to procure these samples after an interval of dry atmosphere, of at least eight days (October the 10th, 1872, being the date); thus giving us the important assurance of absence of dilution of the river with rain. Since then there has been no occasion equally favorable; the incessant and almost unexampled alternations of rains, snows and thaws, having kept up in the river a continual condition, more or less, of flood. It has not been easy, therefore, to get the further samples of the water, representing an average of the stream at and about Paterson, to show the direct effects thereon of the sewage of that city. Patience, however, was at last rewarded by an opportunity (January 28th, 1873), the river having fallen several feet after a hard clear frost of at least six days, showing a partial failure of the flooded flats and tributaries. This occasion was seized to obtain samples from above the Passaic Falls, from the discharge of two of the main sewers, and from the river itself below the discharge of all the sewers of importance, off the Straight street bridge, Paterson.

In connection with the sewers, other instructions received from your Honorable Board were, as far as practicable, carried out, relating to inquiries into sources of possible contamination of the sewage waters by mineral and metallic matters, from the different dye works and factories.*

The conclusions arrived at on these special questions will appear in their due place.†

The samples were taken at Belleville in white Bohemian glass-stoppered bottles, of five quarts each, selected with care. Bohemian glass, it may be well to say here, was used, because it had been found previously, and has also been confirmed since, that ordinary bottle-glass, such as used for acids for example, is curiously corroded by the Passaic water, so that in a few weeks an important sediment will form, of thin scales detached from the glass. The action is almost as marked as that of a dilute solution of carbonate of soda. The cause of so remarkable a phenomenon I can but conjecture as yet. It may be connected with the compounds known as "peaty acids" in the water, some of which the French chemist, Paul Thenard, has recently announced he has found to be active solvents of silica.

The samples were sealed securely, with pure paraffine, at the water works (in the presence of your chief engineer, Mr. Culver), and after being packed in an inverted position, were transported to the laboratory of the writer in Hoboken.

Preliminary Preparation of the Samples.

The bottles were placed, without unsealing, in a light room without fire, which, because surrounded by other rooms constantly warmed, remained above freezing, even during the intensity of the past winter. The primary object was to obtain such *sediments* as might deposit, including possible products of germination and growth of vegetable spores. In about one month (November 14th), the samples of water, having then become perfectly limpid, though of a pale brownish tint, were carefully pipetted off from the sediments, the latter collected, dried at an extremely gentle heat, weighed, and reserved for examination as below. The clear pipetted waters were transferred to the glass-stoppered Bohemian bottles, and kept, during the progress of the analyses, in the same uniformly cool room.

The sewage and other samples from Paterson (taken January 28th) were treated in the same way. In one month they had all settled clear, and were pipetted off; except one, from the Paterson street sewer (the largest sewer), which had, from an original almost milky whiteness, become very dark, almost inky in aspect. On filtering through paper this, however, became also nearly clear, and pale in color. The dark color was due to a trace of sulphide of iron.*

To examine any change of the sedimentary matter produced by the flow through your iron pipes, a sample was taken in my Hoboken laboratory, at the same date as those at Belleville, and placed by their side, to obtain the sediment. This being in a green-glass bottle, however, the corrosion above mentioned quickly took place, and the sediment being thus contaminated was rejected. Another similar sample was then taken November 1st, in a Bohemian bottle, and left to stand to deposit till December 1st.

The Methods of Analysis.—General Observations.

As little prolixity will be indulged in under the head of description of methods, as is compatible with the justice due to the undersigned, for what has been novel or special in the methods he has used, or in the views he has to convey regarding accepted methods.

The older methods of analysis of potable waters, by which it has been customary to determine with great precision the actual quantities and relative proportions, per stated volume, of all the different acids and bases belonging to the purely "inorganic" constituents, have, within a decade past, fallen into disrepute and even desuetude among some chemists who have been active in the advancement of sanitary chemistry: and a far greater importance now attaches, among these, to the so-called "organic" constituents, or rather those assumed to be peculiarly of organic origin. This latter school of chemists and sanitarians has in many cases abandoned the practice of determining anything regarding the solid so-called "mineral constituents" more than their simple sum total, after expelling all volatile matter.†

This is deemed by the writer an ill-considered conclusion, as he feels it at present impossible to draw any safe line of demarcation between these two classes

* Of course I am not to be understood here as having any reference to *facts* ascertained by previous investigators, of which abundant use has been made.—H. W.

Those of the balance, the beaker and the burette.

* In this somewhat delicate inquisition, acknowledgment must be made for valuable assistance, received from William Neilson, Esq., the City Editor of the Paterson *Daily Press*; nor must mention be omitted of John T. Hilton, Esq., of the City Surveyor's office of Paterson, without whose zealous and active co-operation it might have been impracticable to obtain proper access to the sewers, and information needed regarding the system of drainage.—H. W.

† It did not lie within the scope of my instructions to collect, for examination, any samples of the water below Belleville, or within the immediate influence of the sewage of Newark, and I have therefore been obliged to confine my examinations into this influence to the high tide water at Belleville. —H. W.

* To obtain these sediments, and free the water from them, without loss of time, I thought at first of trying methods recently suggested and even used by some water-analysts, of adding known weights of alumina salts, or of chloride of calcium, which quickly coagulate the suspended matters. Reasons that I will not now occupy space with, deterred me, and I have since been pleased to find my conclusions confirmed by the President of the London Chemical Society, the eminent chemist Williamson, who at their meeting of December 19th, declared these expedients to be "highly improper," as "it was almost certain that a change would be produced." The only reliable mode, I believe, is that I adopted, similar to that of Nature.—H. W.

† The highly valuable Manual on Water-Analysis, by Wanklyn and Chapman, is an example of this, and, I fear, has done much harm in this direction.

of ingredients. Not to enter into too intricate a discussion, it may be safely asserted that most of the dissolved constituents of fluviatile waters are derived either from or through agencies of organic matters, and are rendered into their forms of solution by such agencies.

From this it will follow that when we have penetrated all the problems involved, every constituent in a river water will be found to throw light on the organic changes, either of growth or decay, occurring in or on the soils and rocks that receive the atmospheric condensations from which all fluviatile systems are fed. Let us recall that surfaces of rock undergoing decomposition (as regards the feldspathic compounds), are almost always found encrusted with live *lichens* ("rock mosses"), whose *excreta* and decaying remains are, the writer believes, most important vehicles of convection of the constituents of the feldspar, and other minerals of the rocks (the silica, the lime, the magnesia, the alkalies, the phosphates, and so on) in soluble form, to the waters that fall from the atmosphere. The corroding agency of these classes of vegetation has always been known and recognized, but the writer thinks that the importance of this agency in dissolving rocks in rain-water, and thus contributing to the dissolved contents of river waters, has not heretofore been recognized in the literature of science. At the same time, a portion of the products of the death and decay of the successive crops of lichens enters into solution, imparting to the water ingredients found in most of our rivers, above tide-flow, which are usually known as "peaty matters." Much of the e colored organic matters, it must be added, however, are doubtless really derived from peat bogs. With regard to the "saline" matters dissolved out from soils, or disintegrated rocks, the writer thinks that chemists will generally concur in the view that these are largely, if not chiefly, due to the direct chemical agency of vegetation or of decomposed and decomposing products thereof.

There is, on the other hand, another school of water-analysts, which adheres to older ideas, and, as the writer believes, exaggerates much the difficulties and uncertainties its adherents attach to most of the more recent methods of detecting and determining constituents present in quantities too small to be weighed—a class of constituents comprising many of the products of putrefaction and decay. This school goes so far in the other direction, as to reject the modern "micro-chemical" methods, as of no practical value. In a recent report on the Albany water supply, the distinguished author appears to take this view, and has given no details of attempts to apply micro-chemical methods or color-tests for organic matters or their derivatives, in the Hudson River water. He says: "There are unfortunately no really satisfactory tests that can be applied to a sweet water, free from taste and smell, to determine, with absolute certainty, the absence or presence of *small* quantities of noxious organic substances."

From this conclusion, and from the general views of both the schools of chemists referred to, the present writer's own experience forces him to dissent; and, in brief, his own belief rests on the middle ground between these two schools; and, in this investigation he has deemed it essential to apply, as thoroughly as possible, *both* the older and newer schemes of analysis.

SPECIAL OBSERVATIONS ON METHODS.

As, in a work of this kind, much depends on great precision in the determination of quantities of constituents, even though these are mostly very minute, it is well to say that when the samples of water were *measured*, such measurements were made with a precision equal in reality to weighing by the balance; that is, calibrations were previously made of all the measuring tubes and vessels, by reference to the balance itself; and all the measurements corrected by reference to calibration tables founded thereon. In many cases the water itself was weighed directly in small successive portions, as evaporations or other processes progressed.

Minute accounts of the modes of management and manipulation in evaporating the different samples, and of the methods of treating the residues, would be out of place in this report, if only because they would swell it beyond all reasonable bounds. All such purely laboratory details will be avoided, as much as may be found consistent with intelligibility.

The residues left by all the samples of water on evaporation in white porcelain, were of an orange-buff, approaching to salmon-color, while those left in platinum dishes were gray in color; and all, on heating, turned black, with a strong "peaty" odor, or at least an odor recalling strongly that of peat smoke. This odor, however, is of little value in itself as an indication of the character of the volatile matter present; but subsequent tests proved the presence of one or more of the peaty acids. The incineration was very difficult, more like that of animal matters; and at the point of temperature required to form a white ash, a slight fume was often seen, though too slight to allow its character to be determined. The ash was nearly white, and effervesced slightly with acids, dissolving in muriatic with a distinctly yellow color, indicative of iron.

In addition to the samples from Belleville, it was thought important to take the opportunity to obtain the *average* composition of the water for the winter months, just as delivered and used by consumers, sediment and all, from the service pipes in Hoboken. During nearly the whole month of December, and a few days of January therefore, five series of evaporations were carried on, of water collected daily in successive quantities from a spigot in the laboratory, at all hours of the day, and even of the night, the evaporation going on night and day. In one of these cases, during twenty days, as much as twenty quarts of the water were concentrated in a platinum dish on a water-bath, the object in this particular case, as well as in one other, having been to determine the ammonia, a drop of sulphuric acid being therefore added at the outset. It is to be remembered that these results on the hydrant water (reported in the fourth columns of the two tables of analyses given below), relate to an unusual winter period, during which the stream was more or less in continual flood. The effect of such conditions on the composition of fluviatile waters has not, so far as I know, been settled, and it is a complex, indeed impossible problem to *guess* at, in the absence of numerous comparative analyses.

The interval of one month mentioned above, before beginning the direct analyses of the Belleville samples, was not spent in idleness. Within a few years some European analysts have been active in devising new methods of discovering and determining substances which, though often occurring in waters in proportions justly termed micro-chemical, are nevertheless widely believed now to be of vital importance in a hygienic view. Most of these methods are still matters of distrust to many chemists, or at least of discussion and dispute, as to their reliability. It appeared a matter of absolute duty in this case therefore, that such of these methods as appeared important and promising should be submitted to such critical and exhaustive tests, as might inspire, in the undersigned at least, some confidence. The amount and perplexity of the labor involved in this were great; and it might indeed be carried on endlessly, but that life is short.

The month referred to was, however, thus occupied, and I may add, a large part of two months following; and it appears appropriate and requisite that a few specific though brief paragraphs (which may be more especially interesting nevertheless to readers of chemical attainments) should be given to an enumeration at least of the following methods, thus submitted to examination, and some of which were since made good use of in this research.

The Forchhammer-Condy Permanganate method; with the modifications recommended by Angus Smith, in whose high opinions of the real value of this method, when used understandingly, the writer must largely concur, though he has spent comparatively little time in actual work with it.

The Nessler-Hadow method for ammonia; which, as all chemists now familiarly know, is beyond all price or appreciation, in all chemical analysis, that for sanitary purposes included. To illustrate the extraordinary value of this Nessler-Hadow micro-chemical method, and the enormous stride in advance marked by it, it may here be added that in the evaporation before referred to, of twenty quarts of hydrant water with acid, occupying twenty days, an attempt made to determine ammonia in the residuum, by common alkalimetry, failed altogether. In another parallel experiment, however, involving considerably less time and material, no less than five well-concurrent determinations were made, upon the result of distillation with alkali, and three times as many more might have been had. The average figure arrived at is given below—0.005 grain of ammonia per gallon. The failure of the ordinary volumetric methods is here clear enough, when we consider that the whole five gallons concentrated contained but one-fortieth of a grain of ammonia.

The method for nitrogen acids, founded on reduction to ammonia by a metal, and then the Nessler-Hadow method. Schulze's improvement of using metallic aluminum in alkaline solutions, was found valuable; but the writer has found it far preferable to use, in addition, clipped iron wire, which, while hastening the operation by voltaic action, also subsequently prevents explosive ebullition, and bursting of the retorts. [It may convey to your Honorable Board some idea of *one* of the difficulties of this kind of investigation, to add that each repetition of the determinations of nitric acid here reported, and they were many, required alone at least one day of hard and anxious work and watching, and that before the discovery of the above safeguard, a dangerous explosion, involving damage to property, had occurred.]

The volumetric method for the determination of chlorine, with standard solution of silver and chromate of potash, which has been so highly lauded by some chemists, failed altogether in the hands of the writer, and he had to abandon it.

The Alkaline-Permanganate method, for "albumenoids" or Proteine bodies, of Wanklyn and Chapman. This method, which is less understood probably than any of the others mentioned, has been tested with some care; at first with the unsatisfactory results reported by some other chemists, and at last with some degree of satisfaction. Details cannot be entered into here. It is certain that W. and C. proved the existence of some form of nitrogenous matter in potable waters (previously freed from ammonia), which is convertible into additional ammonia (at least in part) by distillation with their new reagent. They also show similar results with albuminous matters, and with the usual immediate products of their metamorphoses, and it is hard to see what *other* substances could get into fluviatile and many other waters, that could give ammonia in this way. It is on these grounds that the writer has provisionally accepted their views and their methods, and put the results into his tables of analytical results. As Dr. Angus Smith prefers the term proteine to albumen, in this case, it has been used here also. As the rule of Wanklyn and Chapman is to consider ammonia thus found to represent ten times as much "albumenoid," the figures in the table stand for but one-tenth as much ammonia.

NEW TESTS OF OXYGENATION AND RATE OF AERATION.

The writer has the satisfaction to announce here that, in the progress of this work, he has found new and valuable microchemical tests for potable waters, as to both the existing degree of aeration (or impregnation with free oxygen) and the rate of absorption of aerial oxygen; which he believes will be of especial value in determining the questions that have arisen regarding the Passaic water. Eminent chemists and sanitarians are agreed upon the important bearing of this ingredient (free oxygen) in potable waters. It has been considered as furnishing a measure of the freedom from liability to undergo fermentation or putrefaction; and it will scarce be denied by any that the most highly aerated water is, *ceteris paribus*, the safest. Oxygen is a consumer and destroyer, and in water destroys the enemies to human life therein. Indeed it is too often the destroyer of human life itself, but with that we have now nothing to do. Streams flow through an atmosphere containing one-fifth of oxygen, but their precise actual contents, and their relative tendency to absorb, and their actual absorption of this agent—which latter is regarded as the measure of their ability to purify themselves—have heretofore been little more than matters of pure guesswork or conjecture. A reasonable hope may now be held that all this will soon be changed. Two or three of the curious and unexpected results of this new method may be mentioned.

Sewage which smells offensively of sulphuretted hydrogen still retains free oxygen, in traces readily indicated by this test.

Water may be *boiled* indefinitely, even boiled away altogether, but retain to the last traces of free oxygen.

Common salt expels all the oxygen from water—with certain precautions—the true explanation of its preservative power:—etc., etc.

Results with these methods upon some of the samples of water, will be occasionally referred to; but their discovery is too recent, and the time and mind of the writer have been too much taken up with other work which your Honorable Board will probrbly deem of more immediate importance, to allow him to test these novel methods to their full extent. The general conclusions drawn from their application will however appear in the sequel.

[To be continued.]

The Silber Light.

The success which had attended the practical trials of the Silber Light in its practical application for the purpose of public illumination was referred to in the *Mining Journal* some few weeks since, upon the occasion of an influential company being formed for acquiring the inventor's British patent rights and developing trade arising out of them; and from the progress which has even already been made, congratulation may fairly be offered to all concerned upon the excellent prospect of the commercial portion of the business proving as highly remunerative as could be desired. To practical men even to test a new invention it is necessary to offer them very decisive evidence that the invention is not only correct in principle but also likely to secure economical advantages in use; and when these practical tests have been made the public need seldom ask further proof of the real value of the proposition than that afforded by the fact whether or not the use of the invention has been continued after the expiration of the period fixed for the

probationary trial, not only has the invention continued in use, but it has been much more extensively applied. India, moreover, appears desirous not to be behind this country in its appreciation of the invention, for already the Silber Light has been adopted for the new railway station at Madras, and has given such complete satisfaction that Messrs. Oakes and Co., the local representatives of the patentee, are sanguine that its adoption will become general, especially as it is found that the cost does not amount to half a pie per lamp per hour, and that the labor of attending to the Silber Light is not one-tenth of that which has been necessary with every form of oil lamp previously used. Upon the occasion of the opening of the station many of the leading Government officials, the members of council, the representatives of the railway company, and the leading merchants and tradesmen of the city were present; and those who have had the opportunity of seeing in this country the softness of light yet enormous illuminating power of the Silber Light will readily understand that the station presented an imposing sight when they learn that there were 13 wall lights, 75 hanging lamps, and several catoptric lamps, all carefully disposed to produce the best possible effect. The praises bestowed upon the invention and on the inventor must have been most gratifying to those interested in the Indian agency, the remark being very constantly heard that the effect equalled that observed in the largest and best illuminated stations in England, which, in a locality beyond the reach of gas, cannot but be regarded as a very significant expression of opinion.

That the Silber Light can be advantageously used as a substitute for gas in large towns where the gas mains are in every street and the fittings already provided in the houses, is not claimed even by the inventor himself, but there are innumerable places where the number of lights required is insufficient to justify the erection of gasworks, although the necessity for a small number of brilliant lights is, nevertheless, desirable. The Madras railway station was a case of this kind, although it is not necessary to look so far as India to find instances in which the brilliancy of gas without the costliness of gasworks would be a desideratum; indeed, the course taken by the Great Eastern, Metropolitan, London, Brighton, and South Coast, and other railways has already been mentioned, and reference was also made to the certificate of Mr. Myles Fenton, the general manager of the Metropolitan Railway, in which he stated that the Silber lamps which "have been fitted in one of their trains for about nine months have proved very satisfactory. Perfect lighting is essential on this line, and their experience so far has proved that the Silber lamps are the best that they have used, both as regards illuminating power and economy;" whilst the Great Western Company has now given further proof of its appreciation of the practical utility of the invention by adopting the Silber Lights for the general illumination of the Taplow station. As the Great Western Company had already had nearly 12 months' acquaintance with the lamps it may fairly be assumed that the lighting of the Taplow station by the same means was not decided upon without mature consideration, and it may be equally fairly assumed that as the comparison with 70 other stations of the company has proved extremely favorable in point of economy, the same system of lighting will speedily extend itself to the almost innumerable stations in the kingdom which are at present in a state of most melancholy gloominess, although an amount far greater than that now paid for lighting Taplow station is expended upon them.

That the Silber Light is able successfully to compete with coal gas at 3s. 9d. per 1,000 cubic feet is, no doubt, due to some extent to the facts that Mr. Silber's invention permits of mineral oil being consumed under the most favorable conditions, and that mineral oil is the most economical burning oil manufactured, but that the economy depends principally upon the construction of the Silber Lamp is obvious, since the best of the mineral lamps previously constructed have been comparable with gas only when attended to and regulated with the care seldom found outside the chemist's laboratory, and even then have scarcely approached it in point of economy. Nor is this the only proof that the higher illuminating power and greater economy obtained are due to the invention, and not to the use of a special quality of burning fluid: for we have recently seen ordinary colza oil burned in a moderateur lamp of the ordinary form, but fitted with Mr. Silber's invention, which, although consuming about the same quantity of the same oil per hour, gave a light four times as brilliant as the fellow-lamp in its unmodified form; and it speaks well for the invention that not a single instance has occurred in which the Silber Light has failed to give satisfaction, although in the course of his experience the inventor has naturally been able to render the light still more nearly perfect by slight modification of detail. The invention will certainly come into general use, and cannot fail to prove highly remunerative to all concerned in its development.—*London Mining Journal.*

A Mysterious Gas Explosion in Buffalo.

Yesterday morning, about half past eight o'clock, the people living in the vicinity of Court street, between Sixth and Seventh streets, were startled by a heavy explosion. It was discovered that the pipe or pipes of the Oxyhydrogen Gas Company at that point had burst with such violence as to tear up the street at the point where the explosion took place. New pipe was soon substituted for that torn, and in a little while the clay was piled in and the pavement restored. This explosion must be explained. Three of the gas meters of the company exploded in rapid succession at the Academy of Music. They had not the usual pretext for exploding because neither time was there any light brought into proximity to the meter. Now if the street pipes take to exploding it is high time that the public should have an explanation of the matter. If the oxy-hydrogen gas has violent, combustible qualities, which take it out of the control of those who ought to be its masters, the sooner we know it the better. To all appearances there is a little problem here which is not very easy of solution.—*Buffalo Courier.*

THE OXY-HYDROGEN TROUBLE.

A WORD OF EXPLANATION IN RELATION TO EXPLOSIONS.

BUFFALO, May 4, 1873.

Editors *Buffalo Courier:* The explosion of gas in two meters at the Academy of Music a few days since and in one of our disused main pipes on Court street on the morning of May 1st (at four o'clock by the by) has been the cause of many inquiries as to what was the trouble, and no doubt a large number of people have been led to believe that some terrible danger is hidden under the name of the "oxyhydrogen gas." To relieve the public from any such fear and the company from an unjust supposition, that they would continue to place citizens in jeopardy of their lives by supplying an unusually explosive gas is the object in asking you to publish this communication.

Some weeks ago it was decided by the board of directors of the Buffalo Oxy-Hydrogen Gas Company to discontinue the manufacture and supply of oxygen gas for two reasons—either of them good and sufficient, viz: because the consumption of the gas was far too small to warrant the expense of its manufacture, and because a leak of considerable magnitude existed along the line of pipe. All of the customers for the oxygen gas, except at the Academy of Music, ceased its use. At that place the accident above referred to arose, so far as ascertained, from an imperfect connection of the burner, which permitted the carbureted hydrogen to pass down into the oxygen meter.

After the connection between the gas holder and the street mains was severed, a defective burner on one of the public lamps allowed the hydrogen to pass back into the unused oxygen main, and fire communicating with the mixture of the two gases caused an explosion. When this section of pipe was removed it was found to be badly fractured, but that the breaks were not fresh, and evidently the result of original imperfections.

It may not be known to many of your readers that carburetted hydrogen (or illuminating gas) made under *any* process, will, when mixed with the proper proportion of atmospheric air, become highly explosive, and if fire is communicated to the mixture a violent explosion will occur. Whether the oxygen is diluted as in the atmosphere or pure, will make little difference in the result.

We would infer from the importance given to the accidents to our Company that the explosion of gas meters is very uncommon, while such is not the case. A careful perusal of the daily papers will show that other cities in which the title of the companies furnishing gas is not so formidable as that we bear have now and then a similar accident. We confess that we did not at first understand why, after six months' experience without any disparaging accident, two should occur in the same place, and we did not wish to attempt an explanation which would not be satisfactory. Still we have a right to ask, when the gas meters furnished by other companies explode, that some reference should be made to that accident, and in connection we desire to know if the explosion of gas in the basement of the Jewish Temple on Niagara street, which occurred Thursday, April 24, was not equally deserving of notice as the two which have called for so much explanation on our part.

In the attempt to introduce a new method of illuminating our streets and public edifices, and to furnish gas at a low rate, we have spared no expense of time or money; but we have found despite all our care that pipes will leak and joints will be defective. When the millenium arrives, perhaps we all can find—and who of us can say he has—that in all cases plumbers, gasfitters, and foundrymen will be infallible? All we have asked and all we do ask, is that the public will believe that we shall do our best to furnish them with good gas, and no more explosive and dangerous than any other similar gas, and not to think that this company is the only one whose customers are aiding to endanger the property and lives of the Buffalonians.

E. S. WHEELER.
Sec'y Buffalo O. & H. Gas Co.

Lighting and Extinguishing Street and Other Lamps.

Amongst the number of projects for lighting and extinguishing public lamps automatically, that recently patented as the invention of Mr. Alexander F. Wilson, of Para, bids fair to be at least as successful as any that have preceded it. The object is effected by the use of the following apparatus:

On the top of the lamp column the service-pipe terminates by being inserted into a small cast-iron ring-tank, furnished with two outlet pipes, and made to contain mercury. In this tank rises and falls a gas-holder, which is divided by partitions surrounding the outlet-pipes; the partition which encircles one of the outlet-pipes is, however, shorter than the other, and this outlet leads to the ordinary burner, while the other outlet is in in communication with a jet burner placed a little below the light-yielding burner. The action of the apparatus is thus brought about: Gas is admitted to the interior through the inlet-pipe, and passes through a small orifice or "permanent leak" in the partition to the jet burner, where it is lighted and kept continually burning. When it is desired to light up the ordinary burners, extra pressure is put on at the gas works, and the gasholder rises and unseals both partitions, allowing the gas to pass freely to both burners, and the consequence is the flame from the jet burner is increased, and readily sets light to the gas issuing from the ordinary burner. The pressure at the works is then reduced, whereon the gasholder descends and seals the partition covering the jet burner outlet, the gas escaping to it only through the permanent leak before referred to, while a free gas way to the ordinary burner is maintained by reason of the partition covering its outlet being shorter than the other. When it becomes necessary to extinguish the lamps, the pressure at the works is still further reduced, whereby the gasholder descends and cuts off all communication between the gas and the ordinary burner, the result being that the flame is extinguished until the time arrives for its being relighted, when on a suitable increase of pressure at the works the same operation is repeated. This invention is one that is perhaps hardly admissible in towns subject to fogs or other causes necessitating an increase of pressure during the day, but in places where no such conditions prevail and labor is dear, it may be adopted with advantage.—*Journal of Gas-Lighting.*

Buffalo Gas-Light Company.

The stockholders of this company, the pioneer of gas-lighting in Western New York, organized in February, 1848, held its twenty fifth annual meeting at the office of the company yesterday. The following Board of Directors was elected:

E. G. Spaulding, O. G. Steele, G. T. Williams, George Howard, Pascal P. Pratt, Ethan H. Howard, William Becknell.

It is worthy of remark that three of the present Board were members of the first Board, elected in 1848.

The late Samuel F. Pratt was its first president and continued in office until his death, about one year ago, thus holding the office for twenty-four years.

The secretary, Mr. O. G. Steele, was its first secretary and manager, and has held that responsible office continuously till the present time.

The officers of the company for 1873 are—Elbridge G. Spaulding, President and Treasurer, and Oliver G. Steele, Secretary and General Manager.

It rarely happens in this changeable world that an institution of this character should remain so long under the same management.—*Buffalo Courier, May 7.*

Carbonic-Oxide Poisoning.

[The fearful effects of this deadly gas are well exemplified by a recent occurrence, the date of which was during the first week of the present month. It is scarce necessary that we should say that the poisonous agent in this case was not "sulphurous fumes," but carbonic oxide gas.—Ed.[

The story of a most melancholy and terrible catastrophe comes from Nazareth, Lehigh county, Pa., by which two leading citizens met their death in a horrible manner. A lime kiln belonging to one of them, named Lichtenwallner, had become choked, and on Monday evening last he, with a neighbor named Haldeman, mounted the kiln, and with a long iron rod forced a hole down through the lime. When the passage was made a jet of sulphurous gas rushed upward, and Lichtenwallner was overpowered by its fumes before he could get away. His companion, to his horror, saw him pitch head first into the kiln. Supposing he had lost his balance, Haldeman rushed to the spot where Lichtenwallner had stood to render him aid in getting out. There was a large quantity of lime in the kiln, and Mr. Haldeman seeing his companion lying upon it, bent forward and actually succeeded in getting hold of him. As he raised up, the sulphurous fumes struck Haldeman in the face, and he instantly lost all consciousness, and fell after Mr. Lichtenwallner into the kiln. Theodore Walters, a man living on the Bath road, was driving by at the time Haldeman ran up to the top of the kiln. Attracted by his actions Walters started up to see what was the matter. Before he reached the top he saw Haldeman fall into the pit. Walters made all haste, and, seizing a ladder that was near the kiln, ran to the top and lowered it down to where the men were lying. Seeing that they both were unconscious he ran down the ladder, and seizing the body of Lichtenwallner, started up with it. Before he reached the top he too was overpowered by the noxious vapor, and fell back into the kiln. Fortunately some parties working near had seen Walters go down into the kiln, and surmising that something was wrong proceeded thither. They reached the top just as Walters in his noble effort to rescue the bodies of the two unfortunate men, had fallen down unconscious. One of the new comers, without an instant's delay, rushed down the ladder, and seizing the body of Walters, succeeded in reaching the top with it, but not without feeling the effects of the gas. Walters was laid on the ground, and a boy despatched for a doctor. His rescuer, after getting a breath of fresh air, again risked his life to bring out the other bodies. He rescued them both, by which time Walters had been restored to consciousness. Lichtenwallner and Haldeman, however, were dead.

Siemens's Regenerative Gas-Furnace, with Peat as Fuel.

Action has recently been taken by the Council of the Royal Dublin Society on the important question of the utilisation of peat in manufactures. Professor Reynolds suggest the use of a mode of employing peat as fuel for industrial purposes, which appears to have been either overlooked or entirely neglected. In his opinion the successful and economical use o; peat in manufactures is more likely to depend on the proper adjustment of the furnace to the fuel, than of the fuel to the furnace, the costly preparation of peat being open to many serious objections.

In 1862 the venerable Professor Faraday delivered his last lecture at the Royal Institution of Great Britain, and took for his subject "Siemens's Regenerative Gas Furnace." At the time, Professor Reynolds was very much impressed by the admirable apparatus described, in consequence of the facilities it afforded for the combustion of any such bulky fuel as peat. Since 1862 Mr. Siemens has taken out no less than eighteen patents for improvements in his apparatus, and now it appears to be exceedingly well-adapted for peat burning. In the regenerative gas furnace, the fuel is very simply converted into combustible in a separate chamber of peculiar construction, the gases are then conducted into the furnace containing the material to be heated, and are then burnt with hot air. After use, the intensely heated products of combustion are made to pass through brick chambers called regenerators, and the heat which would otherwise be wasted is caught, stored up in the bricks, and subsequently made to raise to a very high temperature the air, etc., required to supply the furnace. In addition to the economy of heat resulting from the use of this apparatus, two special and most important advantages are gained. In the first place a bulky fuel like peat, containing a large proportion of worthless and injurious ash, can now be successfully employed in several important manufactures, since it is no longer necessary to bring the solid fuel into direct contact with the material to be heated. Secondly, the use of a very dry fuel is not required, owing to a peculiarity in the mode of working the furnaces. Siemens's apparatus is therefore specially suitable for the combustion of rough and simply air-dried peat.

Mr. Siemens states that his opinion perfectly agrees with that of Professor Reynolds. "I have used peat abroad for working glass furnaces, and have employed it with complete success for making steel in England; indeed the men gave the preference to peat over Staffordshire coal in working the regenerative gas furnaces. In England, coal is, of course, the cheaper fuel; but I am convinced that through the application of peat, as Prof. Reynolds suggests, several branches of industry may be planted with great advantage in Ireland. Regarding the heating value of peat as compared with coal, it can be arrived at for my purpose by simply ascertaining the relative percentage of solid carbon in both. The water (if not in excess) may be regarded merely as a deduction, without injury to the heating value of the solid constituents. The vapor of water mixed with the gas is all condensed in the cooling tubes of my apparatus before reaching the furnace."—*Iron*

[These views regarding the true functions of peat, as a fuel for manufacturing operations seem fully worthy of attentive consideration. There is much more on this subject which we shall follow up hereafter.—Ed.]

Peat beneath London.—Mr. J. R. Scott, the Registrar of the London Coal Market, has made the discovery that under London there is an immense deposit of peat. He maintains that there are millions and millions of tons "within seven miles of the Royal Exchange, and within ten feet of the surface of the soil, extending from Bow Creek along both shores of the Thames to its mouth, which only require to be dug, dried, and scientifically treated to produce a valuable fuel fit for all and every purpose for which coal is now used."—*Iron.*

A jet of gas from a well in Frankfort, Ky., on being lighted, gave a flame ten feet high, and as it could not be turned off or blown out, a fire engine had to be used to extinguish it.—*Eagle.*

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FRIDAY, MAY 16, 1873.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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CONTENTS.

☞ An asterisk (*) denotes an illustrated article.

*Fluorescent Relations of Certain Hydrocarbons Found in Petroleum Distillates (concluded) 163
Coal in Italy 164
Chemical Excerpts 164
The "Iron Age" and the Gas Strike 165
Old King Coal 166
Chemical and Sanitary Report on the Passaic River 166
The Silber Light 167
A Mysterious Gas Explosion in Buffalo 168
Lighting and Extinguishing Street and Other Lamps 168
Buffalo Gas-Light Company 170
Carbonic-Oxide Poisoning 169
Siemens's Regenerative Gas Furnace with Peat as Fuel 169
Peat Beneath London 189
EDITORIALS—
The History of the Gas Strike 170
Supplementary Upon Oxygen Illumination 171
Metamorphism and Gold 171

SPECIAL NOTICE.

The private office of the Editor of this Journal, for consultation and correspondence; and as Secretary of the Gas-Light Association, is at
No. 12 Hudson Terrace,
Hoboken, New Jersey.
(Immediately fronting the Ferry Houses.)

THE HISTORY OF THE GAS STRIKE.

The following facts are from headquarters, and therefore strictly reliable:

The strike at the works of the New York Gas-Light Company, June 1872, in connection with the strikes in other branches of manufacture, for a reduction of the hours of labor from ten to eight. The movement was then so general that the Gas Companies of this City and Brooklyn were constrained to yield to the demand, either by a considerable increase in wages or by acceding to the short time. The New York, the Metropolitan, and the Brooklyn companies agreed to the latter course as an experiment, while the Manhattan, and some others, arranged for the continuance of the twelve hours by additional pay. The Metropolitan Company a few days afterwards decided to return to the twelve hour system at higher wages, which was effected after a strike, by the employment of new men. In September the New York Company endeavored to induce their men to agree to the same terms, but were unsuccessful; and the season then advancing when the greatest quantity of gas would be needed, further action was delayed until after the Christmas and New Year holidays.

The Brooklyn Company in January made a successful requirement for a return to the twelve hour rule, with some advance in wages. The New York Company gave a similar notice, which was accepted by the men, in February. One-third of the number being no longer necessary were consequently discharged who immediately applied to be reinstated without advance in wages. This offer being communicated to the men who were retained, they decided to remain on the same terms. It seems then that the *Ins* and the *Outs* united to strike for eight hours, with no reduction of wages; and on the morning of April 5th, notice was given to the Superintenent that unless the demand should be granted, the men would quit the works at noon. The Company having anticipated that a strike might occur, had a boat in readiness to bring there those engaged in place of the old hands. Some delay occurred in organizing the new force and in familiarizing them with the duty, and the supply fell short part of the Sunday night; and was shut off during part of the daytime, in order to provide for the public lamps and night consumption, until on the 11th of April and constantly since that date the full quantity required was furnished.

The above is valuable, as an authentic, historical record, and all readers will, without doubt, participate in our own feeling of thankfulness to President Everitt for his kindness in supplying the same; and we would take the opportunity here to suggest the great benefit to all the fraternity that would arise were there recognized a mutual obligation to furnish to this Journal such statements as the above concerning current events which belong to the history of the progress of the gas interest in America. Still it is true that there is great excuse for dereliction in this respect. The management of a gas works is, with us, no sinecure, and but scant time must usually be left, we suspect, even for reading, much less for assisting to write up, the literature of the art.

Nevertheless, such intercommunication is *imperative*, as we have so often urged, in order to constitute a united interest; and here we may again congratulate the fraternity on the immense stride in this direction (namely, that of intercommunication) which will follow from the establishment of our new National Association. Knowledge is power, and Union is strength; observations which are devoid of originality, but for that very reason, doubtless the more worthy of inculcation, remembrance, and guidance. It will do no harm therefore to put these same truths into a somewhat antithetical form, and to say that ignorance (of current events and their results) is worse than inexperience; and isolation, though not so bad as actual disunion, is certain to involve more or less weakness and indecision.

The almost absolute unanimity that characterized the recent meeting of members of the profession in this city, and the almost unprecedented promptness of the organization which arose therefrom, prove and illustrate several interesting things. One is the recognition by all, without debate, of the expediency of union, for mutual support, instruction and advice. Another is that the argument urged against such an organization in this country, an argument which has been deemed by some a fatal one, namely, the very isolation, necessarily resulting from great distances, was not taken into consideration at all. Doubtless every one of the eminently practical men present took the really practical view that this isolation is the strongest argument *for*, instead of against, the Association. Distances to be overcome involve more time, but not very much more, and more expense, which is not worthy of consideration, in comparison with the objects to be gained. Moreover, a wise provision was made, that will enable companies to be represented in many cases by delegates (provided of course with fitting credentials) who may have shorter distances to traverse, each company being entitled to three delegates.

The present writer, as Secretary of the Association is fully aware of the great responsibility that attaches to himself, and he will quote with perfect accordance and approval, in order to make manifest this sense of responsibility, the following words from a letter of an eminent member of the fraternity, who was, in fact, elected one of the Executive Committee:

"I hope much from the organization, but its success will depend much upon co-operation by Gas-Managers with yourself." *Deo volente*, co-operation will not be lacking, on one side, at least.

To return to the topic we began with—that of gas strikes—there has been accumulation of material of late, of general interest. It is impossible for us to read, or even to inspect *all* the newspaper literature of America; to our confusion we make the confession—aware as we are how greatly it is to our detriment and disadvantage. It follows, for instance, that numerous newspaper accounts of the pending strike in the Brooklyn City Works have not received from us that attention which is indubitably due to their infallibility. It will be of more importance, not to say interest, to put on record here a passage from the report of Mr. Brown, the engineer of the Philadelphia city Gas Works, relating to the strike that occurred in that city during the year last past (1872). The interest attaches, in this case, in a degree, to the fact that this strike was

not directed against one of the soulless monopolies which are traditionally held to rule the realms of gas. *Voila:*

The strike of the men—450 in number—engaged in your retort houses at the Twenty-Sixth and Ninth Ward works, which occurred on the 5th of June (with the particulars of which you are familiar), is taken into consideration. These men quitting their posts on a few hours' notice, and compelled you to employ others to do their work or to submit to their unjust demands; the former course was decided on. The warm weather and impossibility of getting a sufficient number of men accustomed to that character of work, made it necessary for a time to employ a larger force than those engaged in the strike—thereby largely increasing the labor account—these for a time failed to produce the proper amount of gas, not being able to keep the retorts heated to such a degree as to insure a perfect carbonization, increasing thereby the cost of manufacture and reducing the average yield of gas per ton of coal carbonized for the year.

I am, however, perfectly satisfied that the additional expense is nothing to what it would have been had you acceded to their demands, which I have no doubt would have been followed by others more unreasonable."

The strike question will doubtless come up before the Association, and be so handled as to make any individual crudities of our own altogether superfluous.

SUPPLEMENTARY UPON OXYGEN-ILLUMINATION.

Our translation of Schiele's Vienna investigations as was natural and desirable, communications from the parties who have the enterprise in hand in this country. We can but cull, as we can make them out, the *facts and figures* they have to present, the correctness of which is vouched for by parties who are themselves vouched for to us; and we doubt not their dicta; though, as yet, of our own knowledge, we know naught.

Schiele, in his report, counted the prices, in Germany, to consumers, as follows:

1,000 feet rich gas	$2.80
1,000 feet common coal gas	1.80
1,000 feet oxygen (in Paris) at 1 franc per meter cube	7.00

In Buffalo, it is stated that the rich gas made there, by the "Tessie process," the same method that is proposed to be used in Troy (which we understand consists in the making of a water gas, from steam and carbon combined with lime-hydrate, and then enriching this with naphtha-vapor), will cost less than one dollar per thousand feet, when made at the rate of 100,000 feet per day. In Buffalo oxygen has been sold to consumers at $5 per thousand and the rich gas at $2.50 per thousand, which, as stated by our informant, gave them an amount of economy equivalent to forty per cent., and with double the light power.

The average price, in our seaboard cities, as is well known, is not usually below $3 per thousand. The price in Paris, for ordinary coal-gas is stated to be 30 centimes per cubic meter, equivalent to about two dollars per one thousand feet. This is to private consumers; to the city it is but half this, 15 centimes per meter, or about one dollar per thousand.

METAPHORPHISM AND GOLD.

In the May number of the *American Journal of Science*, a letter from Prof. Henry Wurtz to Prof. Dana is quoted, to show that the former promulgated in 1866 the theory that the heat of metamorphism is due to motion in the altered strata. The paper of Prof. Wurtz on the Genesis of Gold, read at the Buffalo meeting of the American Association, was subsequently published (in the winter of 1867-8) in this Journal, then known as *The American Journal of Mining*, and the following paragraph occurs in our number of January 25, 1868 (Vol. V. p. 50):

"There is one related point to which I shall devote a few words; as due weight may not have been attached thereto by geologists, even supposing that it has occurred to any in precisely the same light. This is, that the tremendous dynamic agencies, whose effects of upheaval, subsidence, disruption and displacement, we find so widely manifested, while doubtless themselves engendered of the pent-up heat-energy of the interior, must have given birth to, or have been in part transmuted into heat-motion. Hence I deduce conclusions of great moment, but one or two of which can now be dwelt upon. It follows, for instance, that in our theoretical views of metamorphism, we are by no means of necessity limited, for our essential chemical excitant, merely to that portion of the hypothecated residual cosmical heat which might be supposed to have been retained by the emerging oceanic floor. Neither elevation nor subsidence (both necessarily accompanied by enormous compression) could occur without rise of temperature; though the degree of this rise would, of course, vary very much in various parts of the mass. The era of possible metamorphic changes dependent upon the percolation of superheated waters is thus indefinitely prolonged *even to the present time;* and explanation, both in mode and measure, is thus presented for our thermal springs and many like phenomena."

The credit of this theory, which certainly indicates a true cause (though not in our opinion *the* exclusive universal cause) of the heat of metamorphism, must be given to Prof. Wurtz, though Mallet and others have developed and sustained it. Mallet, in particular, stretches it to cover volcanic heat, a conclusion which we cannot adopt.

In the same series of articles by Prof. Wurtz appears (Vol. V. p. 18) the following paragraph, which is specially interesting in view of the recent discovery of gold in the sea by Sonnstadt.

"It is possible that a very important share of the primeval oceanic gold may still be held in solution. [Here follow some calculations, showing that all the gold now in human hands is less than the 162,000,000,000,000th part of the ocean by weight]. So far as ordinary chemical analysis has yet indicated, the present ocean may contain more gold than the present total weight of mankind in this metal. * * * In this connection, I would recall the celebrated discovery of silver in the ocean water by Malaguti, since confirmed by many others; and would urge that gold be also sought for, with renewed precautions. It may be that if we had for the latter tests as delicate and characteristic as for the former, it would have been already detected."

We reproduce these passages, in justice to one of the most acute investigator and original thinkers among American chemists.

CHANGE OF FIRM.—It will be noticed, by advertisement on page 168, that the business heretofore carried on by Smith & Ellis of Philadelphia, will now be conducted by S. Decatur Smith, who will continue to manufacture cast iron pipes, branches, and turns for street mains, etc.

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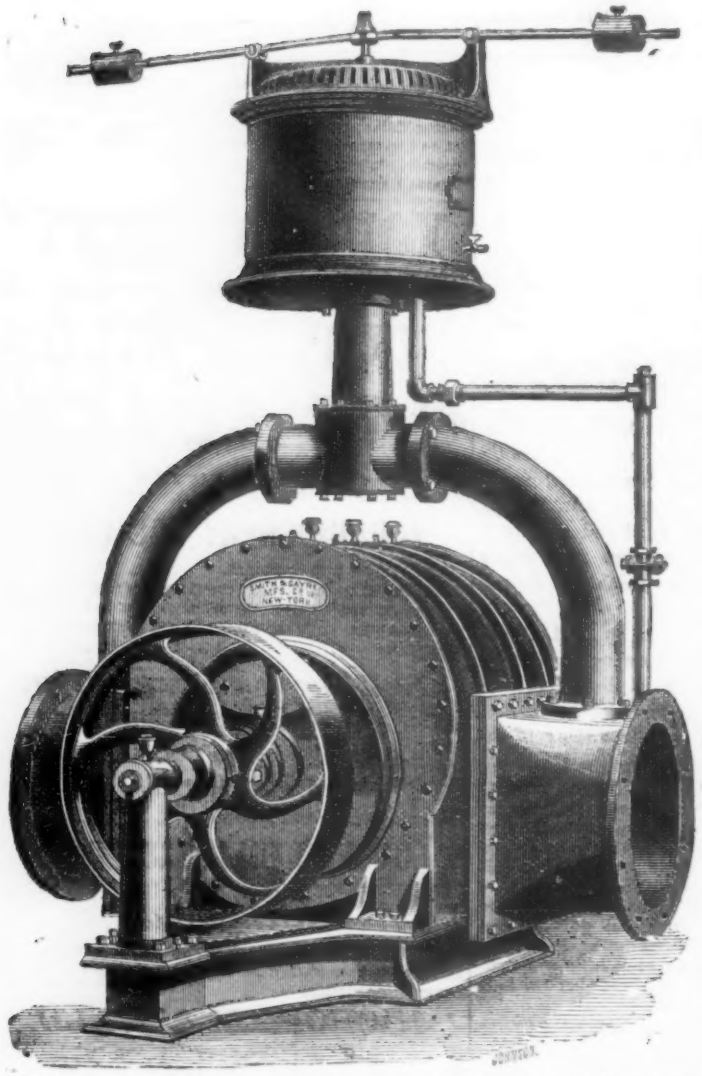

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Testimonials.

PROVIDENCE, RHODE ISLAND, March 21st, 1872

E. DUFFEE, Esq., Agent, etc.

Dear Sir: The Trays manufactured by you for our West Station were put in use in September last, and have *given perfect satisfaction.*

The frames are well put together, and I see no reason why they will not last for a long time. The *very large amount of open space* in these Trays gives the gas an easy passage, and brings it into contact with the lime much better than when the space is so contracted, as is the case in most of the other Trays in use.

The pressure thrown upon the retorts by contracted passages is very great, and were gauges used more frequently than they now are in many gas-works, this facat of having *open Trays* would become more apparent to mangers of gas works. The digerence in pressure at this station in passing the gas through your purifiers, is two-tenths (2-10) inches.

The amount of gas purified, per bushel of lime used to this date, is six thousand five hundred and fifty six (6,556) cubic feet.

Respectfully yours,
JAMES H. ARMINGTON, Supt.

BOSTON GAS-LIGHT CO., Dec. 1871.

Dear Sir: In answer to your inquiry how we like your Patent Tray for dry gas purifiers, I take pleasure in saying we have used them exclusive of all others, for the last three years, and think them far ahead of any yet offered. The surface being nearly three times that of any other Tray, and their lightness and durability perfectly satisfactory.

Yours respectfully,
A. M. GILES.

EDWARD DUFFEE, Esq.

EAST BOSTON, JUNE 15, 1871.

Gentlemen: We have used your Screens some five years. They give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen. Yours truly, A. M. NORTON, Supt.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE.

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 3, 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months, and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, ESQ.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870.

EDWARD DUFFEE, ESQ.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.'
SPRINGFIELD, MASS., Oct. 10, 1871.

MR. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and formerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable, and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them being able to purify over fifty pet cent. more gas with them, than with any other Screen we have used.

Yours respectfully,
THOMAS J. FISHOU.

OFFICE DETROIT GAS-LIGHT CO.,
DETROIT, MICH., April 22, 1872.

AMERICAN GAS SCREEN MANUFACTURING CO., HAVERHILL.

Gentlemen: The Screens bought of you work far better than any we have ever used. As a proof, we have with the same quantity of lime purified *twenty per cent.* more gas with your Screens than with any others, and the work well done. The workmen are also better pleased with them—they being light and handy to work. They also relieve the pressure very much upon the retorts, and I cheerfully give you my experience.

Yours truly,
P. E. DEMILL, Secretary.

We give a list of some Gas-Light Companies using them.

Providence, R. I. Gas-Light Co., Boston, Mass. Gas-Light Co.: East Boston, Mass., Gas-Light Co.; South Boston, Mass., Gas-Light Co.; Springfield, Mass., Gas-Light Co.; New Bedford, Mass., Gas-Light Co.; Manchester, N. H., Gas-Light Co.; Reading, Penn., Gas-Light Co.; Biddeford, Me., Gas-Light Co.; Hartford, Conn., Gas-Light Co.: New Haven, Conn., Gas-Light Co.; New Orleans, La., Gas-Light Co.; Savannah, Ga., Gas-Light Co.; Charleston, S. C., Gas-Light Co.; Trenton, N. J., Gas-Light Co.; Charlestown, Mass., Gas-Light Co.; Dorchester, Mass., Gas-Light Co.; Chelsea, Mass., Gas-Light Co.; Baltimore, Md., Gas-Light Co.; Manhattan, N. Y., Gas-Light Co.; Cincinnati, Ohio.; Gas-Light Co.: San Francisco, Cal., Gas-Light Co.; Albany, N. Y., Gas-Light Co.; Sacramento, Cal.; St. Joseph, Mo., Gas-Light Co.; Leavenworth, Kansas, Gas-Light Co.; Macon, Ga., Gas-Light Co.; Roxbury, Mass., Gas-Light Co.; Lansinghburg, N. Y., Gas-Light Co.; Bridgeport, Conn., Gas-Light Co.; Stamford, Conn., Gas-Light Co.; Poughkeepsie, N. Y., Gas-Light Co; Scranton, Penn., Gas-Light Co.; Lewiston, Me., Gas-Light Co., and one hundred others.

Address **A. P. JAQUES, Treas.,**
Amer. Gas Screen Man'f'g Co., Haverhill, Mass

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GIBSON'S IMPROVEMENT

IN THE

Manufacture of Coal Gas,

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Orders for fitting up Valves of any desired form or patent, *subject to the generality of the Gibson claim*, and also for SUPPLIES and MATERIALS of every description required for the use of Gas Light Companies promptly attended to by

W. H. GRENELLE, Special Agent.

REFERENCE.—RICHARD MERRIFIELD, Esq., late Vice President MANHATTAN GAS-LIGHT COMPANY.

WILLIAM FARMER,

ARCHITECT AND GENERAL GAS ENGINEER,

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WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS and other buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity, Retort Settings, Condensers, Washers, Exhausters, Purifiers, Holders, Coal Hoisting Apparatus, Iron Roofs, and every description of Machinery required in the Manufacturing of Gas.

PATENTEE OF THE FOLLOWING INVENTIONS:

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REFERENCES:

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SAMUEL DOWN, President American Meter Company, N. Y.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
CHARLES MOWTON, Engineer New York Gas-Light Company, N. Y.
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Prof. HENRY WURTZ, Editor AMERICAN GAS-LIGHT JOURNAL.
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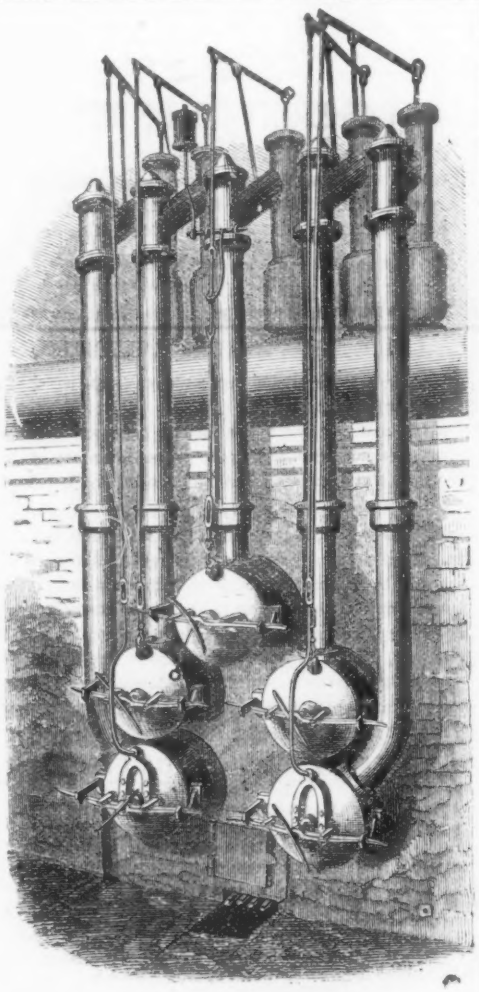
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal. [254-



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ADJUSTABLE AUTOMATIC DIP SEAL,
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Improved Retort Lids.

The Seal closes automatically, when the retort-lid is removed, and is broken by replacing the lid. No mistake can possibly be made. The rods are adjustable in a moment to any contingency. The new attachments are adaptable to any Works. Cost only that of rough castings. No lute used, and no leakage at lids. Half the number of lids only needed. Capacity of mains greatly increased. In new Works no mains. No carbon in retorts, seldom in stand-pipes. Addre

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From the Sterling Colliery.

I am now prepared to place in the market, through my agencies as below, a regular and unlimited supply of this valuable Cannel, for gas purposes. A recent analysis, by Prof. WURTZ, Editor of this Journal, at the Laboratories of the NEW YORK GAS-LIGHT COMPANY, gave 47½ per cent of Volatile Matter and 45 bushels to the ton of a fair quality of coke. The yield of gas was at the rate of 9,500 feet per ton of about 27 candle power. It is not highly sulphurous, can be purified by Lime, and the ash from the coke does not clinker.

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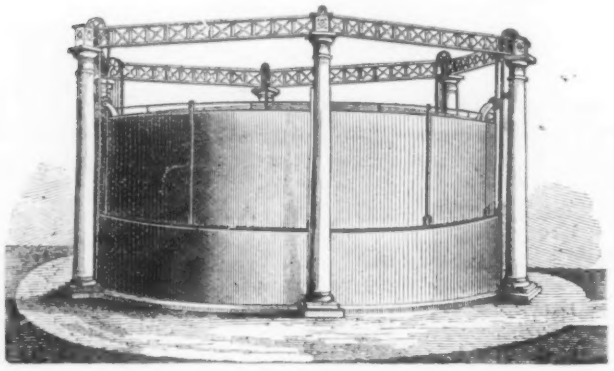

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MADE FROM BEST MALLEABLE IRON AND STEEL.

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E. W. McGINNIS, Secretary and Treasurer.
JOHN P. KENNEDY, Chief Engineer.
LEONARD D. GALE, Consulting Chemist.

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Gale and Rand Patents,

and we are now prepared to treat with you for the use of said process by your Company.

We are also prepared to contract for putting said process into successful operation in your works, furnishing all the necessary plans, materials, and workmen for that purpose.

We do not deem it necessary to enter upon a detailed description, here, of the processes above referred to, deeming it sufficient to state, to secure your interest and investigation, that they have been in successful operation, for months, in a number of Gas-Light Works in the United States, and are now being introduced in the works of the Mutual Gas-Light Company, of New York City; the Citizens' Gas-Light Company, of Brooklyn; the New Orleans, San Francisco, and very many other Gas-Light Companies throughout the country.

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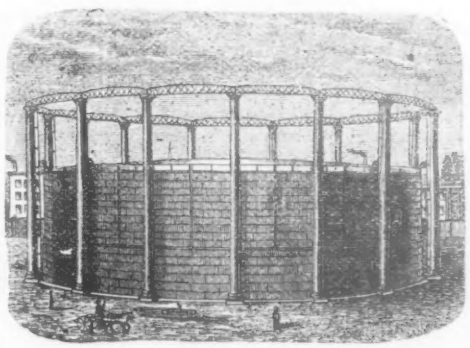

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SINCLAIR & AGNEW, Agents, Alexandria, Va.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

The best dry coals shipped, and the promptest attention given to orders. 224-1y.

PLYMOUTH IRON WORKS.

MANUFACTURERS OF

Cast Iron Gas and Water Pipe,

FROM TWO INCHES TO SIX FEET DIAMETER

HENRY G. NICHOLS,

SELLING AGENT.

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LUDLOW Valve Manf'g Co.,

OFFICE AND WORKS

938 to 954 River Street and 67 to 83 Vail Ave.,

TROY, NEW YORK.

Make Valves (Double and Single Gate, ½ inch to 36 inch—outside and inside screws, Indicator, etc.) for Gas, Water and Steam—also

HYDRANTS.

We would refer to the following among many other Companies using them:

GAS-LIGHT COMPANIES.

Metropolitan, New York; Manhattan, N. Y.; Buffalo, N. Y.; Brooklyn, N.Y. Rochester, N. Y.; Philadelphia, Pa.; New Orleans, La.; Cincinnati, Ohio; Cleveland, Ohio; Columbus, Ohio Chicago, Ill.; Quincy, Ill.; Springfield, Mass.; Milwaukee, Wis.; St. Louis, Mo.; Louisville, Ky.; Memphis, Tenn.; Galveston, Texas.

WATER COMPANIES.

Burlington, Vt.; Keene, N. H.; Concord, N. H.; Springfield, Mass; Worcester, Mass.; Buffalo, N. Y.; Auburn, N. Y.; Utica, N. Y.; Troy, N. Y.; Philadelphia, Pa.; Cincinnati Ohio. Cleveland, Ohio; Dayton, Ohio; Peoria, Ill.; Detroit, Mich.; St. Paul, Minn.; New Orleans, La.; Memphis, Tenn.

"CANTON, OHIO, June 27, 1870.

"We are now using and have been, since the commencement of our works, your valves, and they are proving entirely satisfactory.

"JOHN S. SHORB,
"Superintendent Water Works."

"PEORIA WATER WORKS, July 1870.

"With pleasure I can testify to their superiority. Their action has been perfect under all degrees of pressure, and have given perfect satisfaction.

"S. A. KINSEY, Ex. Sup't.
"JOHN J. STEIGER, Sup't

MURRAY & BAKER,

Practical Builders.

And Contractors for the Erection of Gas Works,

MANUFACTURERS OF ALL THE LATEST AND MOST IMPROVED APPARATUS AND TOOLS FOR THE MANUFACTURE & DISTRIBUTION OF COAL GAS.

☞ WORKS AT THE RAILWAY DEPOTS,

FORT WAYNE, INDIANA.

We manufacture Bench Castings, Washers, "The Immersed Multitubular," and Atmospheric Condensers, Wet and Dry-Lime Purifiers, Dry Center Seals, Telescopic and Single Gas Holders, Wrought Iron Trussed Roof for Iron or Slate, Wood and Iron Trays for Purifiers, Coke and Coal Carts, Wrought Iron Screening Shovels and Castings, and Wrought Work of every description for Gas-Works.

As Mr. Murray is a Practical Draughtsman, we will furnish plans and specifications to parties or associations, or will wait personally upon parties contemplating the construction of new works, or the alteration or extension of old ones.

The most satisfactory references can be given, if required, of the experience and commercial fairness which characterizes our dealings.

We would respectfully invite Western men to call and see our patterns and works here. MURRAY & BAKER,
198-1y Fort diana.

THE AMERICAN METER COMPANY.

Organized under the General Manufacturing Laws of the State of New-York.

SAMUEL DOWN, PRESIDENT. HENRY CARTWRIGHT, VICE-PRESIDENT. THOMAS J. EARLE, SECRETARY.

TRUSTEES:

SAMUEL DOWN WILLIAM HOPPER, R. H. GRATZ, HENRY CARTWRIGHT, RICHARD MERRIFIELD.
THOMAS C. HOPPER, Superintendent at Philadelphia.

This Company is now prepared to furnish WET AND DRY GAS METERS, STATION METERS, GOVERNORS, PRESSURE INDICATORS AND REGISTERS, SERVICE and METER COCKS, and all articles in their line appertaining to the use of Gas Works.

The combination of Mechanical and Scientific Skill, and the long experience of the several members of the Company, is a sure guarantee of durability, accuracy and excellence of Workmanship. Orders addressed

AMERICAN METER COMPANY,

West Twenty-Second Street, New York. Arch and Twenty-Second Streets, Philadelphia. 321 Washington Street, Boston, will meet with prompt attention.

BALTIMORE RETORT AND FIRE BRICK WORKS.

GEO. C. HICKS & CO.

CLAY RETORTS FOR GAS WORKS AND SUGAR REFINERIES.

TILES AND BLOCKS OF ALL KINDS.

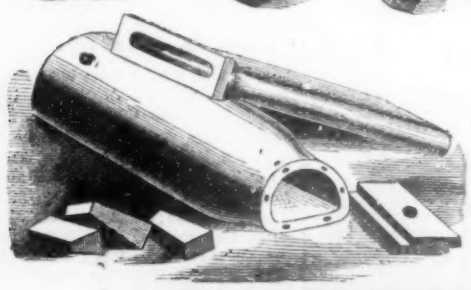
FIRE BRICK.

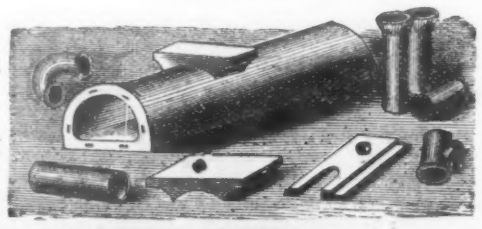
FIRE MORTAR, CLAY AND SAND.

ALL KINDS OF FIRE CLAY MATERIALS

The Only XX Fire Brick.

☞ RETORTS OF THE VARIOUS SIZES KEPT ON HAND.





Vitrified Steam Pressed Drain and Sewer Pipe.

HARRIS & BROTHER,

ESTABLISHED 1848.

PRACTICAL GAS METER MANUFACTURERS,

Continue as heretofore at the OLD ESTABLISHMENT, Nos. 1115 and 1117 Cherry Street, Philadelphia, Pa.,

To manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Centre Seals, Governors, Pressure Registers, Indicators, Photometers, and all kinds of Gas Apparatus; Also furnish all other Articles appertaining to the use of Gas Works.

From our long Practical Experience of the Business (covering a period of 20 years) and from our personal supervision of all Work, we can guarantee all orders to be executed promptly, and in every respect satisfactorily.

J. Wesley Harris, Washington Harris, William Helme.

GAS PURIFICATION.

St. John and Cartwright's

NEW IRON COMPOSITION

Has purified, per bushel, on a single test, 10,000 feet of Westmoreland Gas. With revivification lasts indefinitely. Surpasses in POWER and ECONOMY all known materials. Saves largely in FIRST COST, SPACE, LABOR, SUPERINTENDENCE, and all current expenses. Will purify *easily* sulphurous gas, wholly *unmanageable by lime.* Takes out *all the ammonia.* Now operating in the following Gas Works: Harlem, New York (21st street); Port Morris; Hunter's Point; East New York; Worcester, Lynn and Cambridge, Mass.; Lewiston, Maine; St. Albans, Vt.; Pawtucket, R. I.; Meriden, Ct., and being introduced in many other places.

Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500; $250 additional for each additional 50,000 per day.

For further information and instructions, apply to

ST. JOHN & CARTWRIGHT,
21st Street and Avenue A, New York Gas Works.

☞ Immediate arrangements are urged, as the demand for e prepared composition is increasing *so rapidly* that delays supply may occur.

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GAS HEATING AND COOKING APPARATUS,

FITTERS' PROVING APPARATUS. ETC.,

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MANUFACTURERS OF

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FOR WATER AND GAS,

ALSO,

GAS WORKS AND MACHINERY CASTINGS

OF EVERY DESCRIPTION,

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B. S. BENSON.

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All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

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A **GAS ENGINEER** OF CHARACTER AND ABILITY, now occupying a position in a large Works, desires to change. Fully acquainted with every part and detail of Gas profession, and competent to erect and manage Works of any magnitude. First class Eastern and Western references given, and satisfactory reasons for leaving present situation. Address A. Z., care of AMERICAN GAS LIGHT JOURNAL, New York. 318-21-1eow

1849. HARRIS, GRIFFIN & CO., 1873.

12th and Brown Streets, Philadelphia, Penna.

and 49 DEY STREET, NEW YORK CITY.

Manufacturers of WET AND DRY GAS METERS, STATION METERS, SHOW AND TEST METERS, METER PROVERS, PRESSURE REGISTERS AND INDICATORS, BAR AND JET PHOTOMETERS, WET AND DRY CENTER VALVES, and all Apparatus pertaining to Gas Works in their line.

Patentee and Sole Manufacturer of the ORIGINAL and ONLY CORRECT GAS EXHAUST GOVERNOR.

We hereby caution all parties against making, vending, or using any GAS EXHAUST GOVERNOR that will be an encroachment of our patent.

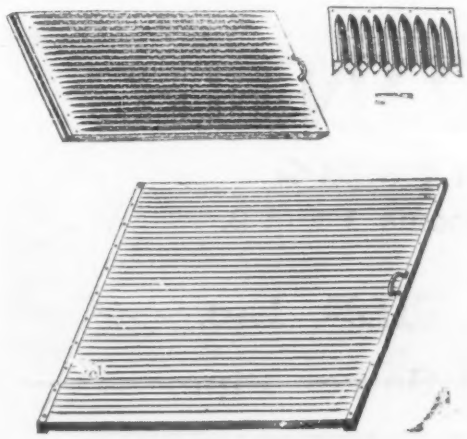
The support and confidence of Gas Companies, so long enjoyed by us, encourage us to pursue the same undeviating course that has contributed to establish the character of our house, and with our extended experience and increased facilities, develop the latest improvement that Science can apply, in the construction of Gas Meters, etc., and thereby merit a continuance of the favors hitherto so liberally extended to us, always guaranteeing satisfaction.

ANDREW HARRIS. JOHN J. GRIFFIN.

J. L. Cheesman,

MANUFACTURER OF

Patent Conically and Diamond Slotted Solid Wood Trays.



To Gas Companies.

The above Trays will last longer. and are cheaper than any Tray now used. They are now made without any outside strips, which gives more purifying surface, being perfectly smooth. The lime will not adhere to them as in other Trays. They are now used in over three hundred Gas Companies in he United States, and other places.

JOHN L. CHEESMAN,
151 and 153 Avenue C, New York.

R. D. WOOD & CO.,

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MANUFACTURERS OF

CAST IRON GAS & WATER PIPES,
Matthews Patent Hydrants,
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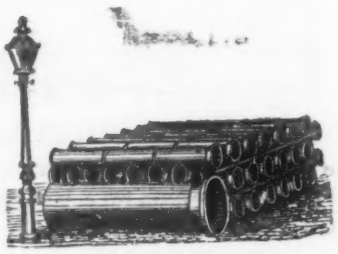


For the accommodation of parties who may want small lots Pipe for *immediate* delivery, we have established a yard in New York City.

We have on hand here several thousand feet of small Pipe. from which we can ship orders readily to any part of the country.

R. PAINE, Selling Agent,
No. 173 Broadway, New York,
SECOND FLOOR.

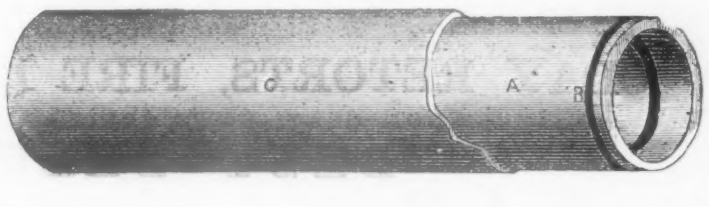
3-tf

NORTHWESTERN
GAS AND WATER PIPE COMPANY.

WORKS, AT BAY CITY, MICHIGAN.

CHICAGO OFFICE, 646 WABASH AVENUE.

SECTION OF GAS PIPE.



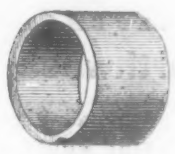


FIG. 2.

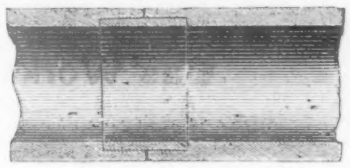


FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3.—Horizontal Section and Connection.

Above is a cut of the

"WYCKOFF PATENT IMPERISHABLE GAS PIPE,"

manufactured by the NORTHWESTERN GAS AND WATER PIPE COMPANY.

This Pipe is made of White Pine, one inch to sixteen inches bore, in sections eight feet long rounded in a lathe, coated inside and out with Asphaltum, connected with a tenon, or socket, and a thimble joint, perfectly air and water tight, being driven together with cement furnished by the Company. When laid its cost is about one half that of Iron Pipe, and is UNQUESTIONABLY the best Gas conducting Main in use.

☞ Send for Descriptive Pamphlet and Price List. 242-1y

S. FULTON & CO.,

PLYMOUTH IRON WORKS,

CONSHOCKEN, PA.,

Manufacturers of

PIG IRON & CAST IRON GAS & WATER PIPES.

Also, Heavy and Light Castings of every description.
412 Walnut street, Philadelphia, Pa.

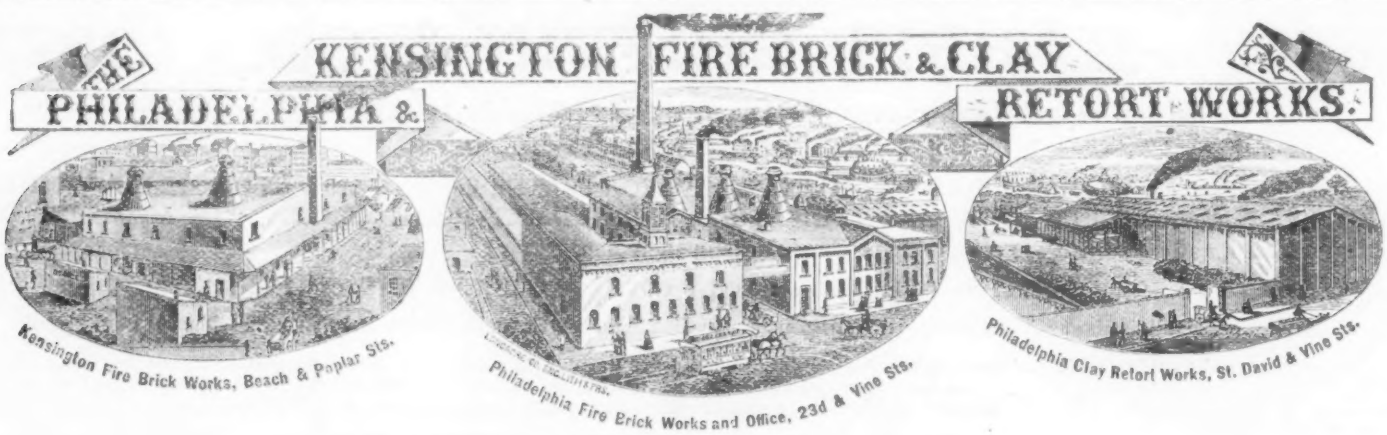
SAMUEL FULTON, THEO. TREWENDT

FOR SALE.

THE AUBURN GAS-LIGHT COMPANY (HAVING PUT in larger Works) offer for sale—Four Purifying Boxes five feet square inside by two feet six inches deep for five Lime Trays six inch connections; one Jet Washer eight feet long—two feet six inches inside; one set six-inch Condensing Pipes and Boxes; six-inch Center Seal (wet).

All the six inch connections for Purifiers, etc. The above comprising all the material we had between Hydraulic Main and Station Meter, and which we used without inconvenience, for the purification of 40,000 feet of gas in 24 hours.

For terms, etc., apply to D. M. DUNNING, Superintendent Auburn Gas-Light Co., Auburn, N. Y. 317-6t


THE
PHILADELPHIA &
KENSINGTON FIRE BRICK & CLAY
RETORT WORKS.
Kensington Fire Brick Works, Beach & Poplar Sts.
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Philadelphia Clay Retort Works, St. David & Vine Sts.

PHILIP NEUKUMET,

(SUCCESSOR TO JOHN NEUKUMET),

Manufacturer of Fire Bricks, Tiles, Gas and Sugar House Retorts.

☞ Plans of Settings for Benches of Threes, Fives, and Sixes furnished, free of charge, upon application.

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Works, Lockport, Westmoreland Co., Pa.

Office, 96½ Fourth Avenue, Pittsburgh, Pa., Rooms 1 and 2.

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK, TILE, Etc.

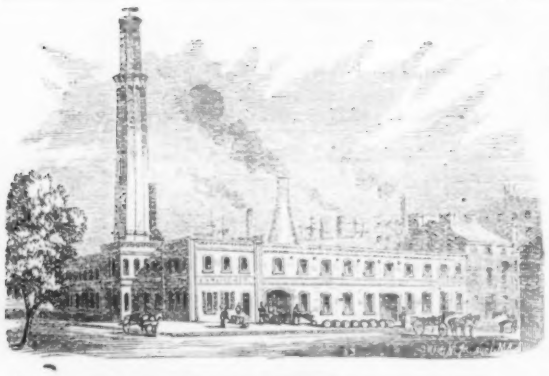
FROM CLAY, SAME SPECIES, AND EQUAL TO

BEST BELGIAN.

☞ ORDERS PROMPTLY FILLED. IMPROVED WORKING PLANS OF THREES AND FIVES UPON APPLICATION.

REFERENCES:

Gas Works Northwest, West, and South.



NEW YORK

FIRE BRICK AND CLAY

Retort Works.

☞ *Established in 1845.* ☜

(Branch works at Kreischerville, Staten Island.)

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OFFICE,

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GAS RETORTS, TILES & FIRE BRICK
Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

Articles of every description made to order at the shortest notice.

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FIRE BRICK & ENAMELLED CLAY

Retort Works.

MAURER & WEBER,

(Of the late firm of B. Kreischer & Co.,)

PROPRIETORS.

Office and Works, 15th Street, Avenue C.

Manufactures of

FIRE BRICK AND TILES,

Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

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GRAHAMITE,

OR

RITCHIE MINERAL.

The yield of this Asphalt is nearly double, and the Candle Power more than double the product of Gas Coals, and it is extensively used by great and small companies, chiefly as an enricher and stimulant, in the proportion of five per cent. Yield 15,000 to 16,000 feet per gross ton. Illuminating power 30 to 32 candles. One bushel of lime purifies 6000 feet. Coke very strong. It is incapable of spontaneous combustion or caking in the heap, and is used by simple addition to the charge.

We sell at figures which allow a much larger profit to the purchaser, with better light than any standard coal.

No gas material is at once so safe and so cheap. Our Asphalt is used in the manufacture of Varnish, Roofing, Ship Paint, Tiles, Pavements, Water Proof Paper, Cloth, and for all purposes where a coating is required that is unaffected by Water, Gasses, Alkalies, or Acids.

The Ritchie Mineral Resin and Oil Co.

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GAS METER WORKS.

R. M. POTTER & CO.,

MANUFACTURERS OF

CONSUMERS GAS METERS, WET AND DRY,

Station Meters, Center Seals, Governors, Pressure Registers,

AND ALL KINDS OF PRESSURE GAUGES.

Experimental Meters and Standard Test Gasholders,

☞ And all apparatus in use at the Gas Works ☜

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LACLEDE FIRE BRICK

AND

Clay Retort Works,

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Laclede Fire Brick Manufacturing Co.

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Price $5, which should be sent either in Check, P. O. Order, or Registered Letter.

Blank Books, with printed headings and forms on this system, will be supplied to Gas Companies, by applying to W. P FODELL, Philadelphia, or

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GAYLORD IRON AND PIPE COMPANY.

Office, 90 and 92 Broadway, Cincinnati, Ohio.

Works, Newport, Ky.

T. G. GAYLORD, President. S. B. BROWN, Superintendent. C. B. FOOTE, Secretary and Treasurer.

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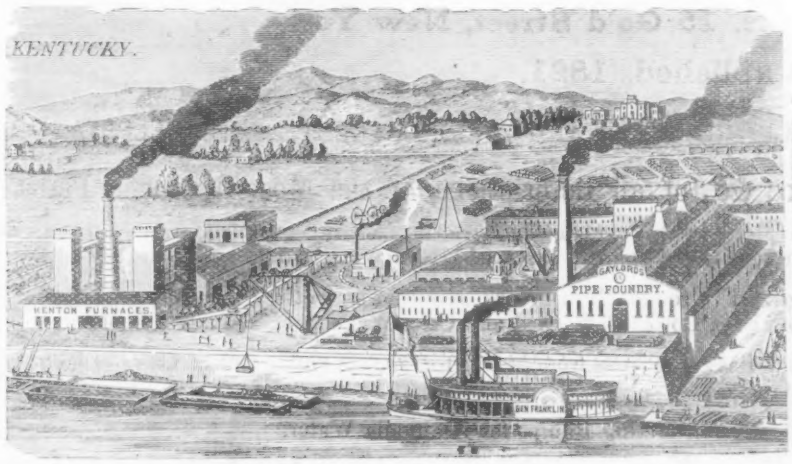
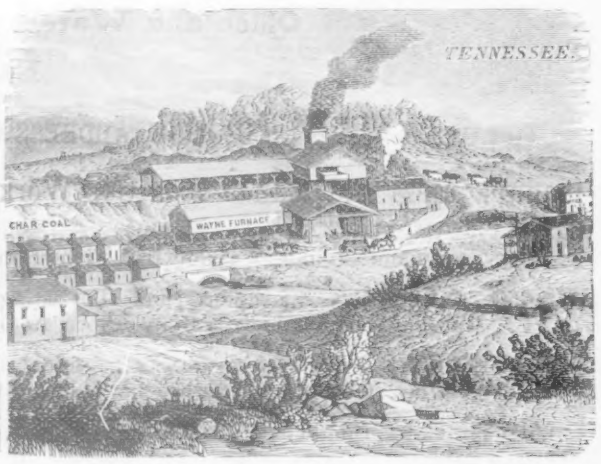




CAST IRON GAS AND WATER PIPE.

And all forms of Special Castings for Gas and Water Works.

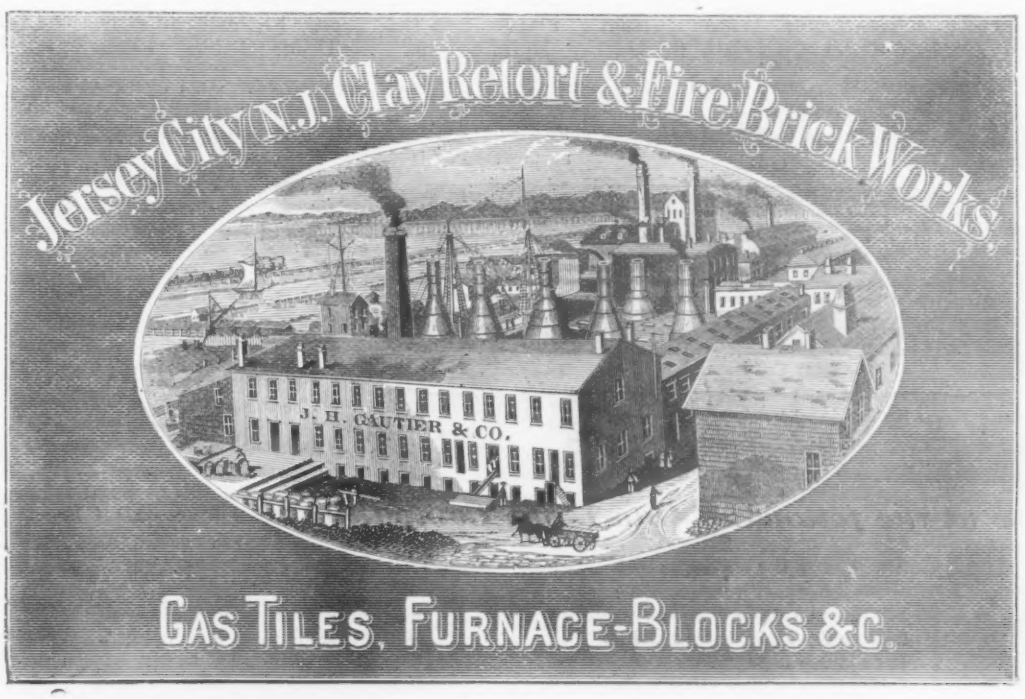
PIPE—2, 3, 4, 5, 6, 8, 10, 12, 14, 15, 16 to 60 inches: above 3 inches Cast in Dry Sand in 12 feet Lengths.

FLANGE, STEAM and HEATING PIPE.

Our KENTON FURNACE gives us a fine quality of Stone Coal Iron; this with our Tennessee Charcoal Iron, which we retain for our Foundry use, enables us, by controlling our Iron, to turn out Castings of a uniform and superior quality, and at a cost advantageous to our Customers.

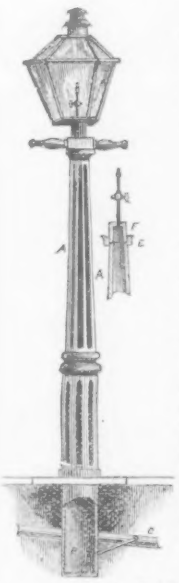
Exclusive Manufacturers of the **ROBBINS JOINT** for Street Mains. The Superintendent of the Indianapolis Gas Company (and many others) say of this Joint: "Its superiority consists of facility in laying, economy in time and lead, and above all, its perfection as a joint.

Estimates given for Furnishing and Laying Street Mains with either common or Robbins Joint.



GRAHAM'S

Patent Anti-Freezing LAMP POST.



THE BEST, CHEAPEST AND MOST DURABLE POST EVER OFFERED TO THE PUBLIC.

WOOSTER, OHIO
Jan. 24, 1871.

J. W. GRAHAM,

Dear Sir: Yours of the 14th inst at hand. In reply I would say that we have tested the six anti-freezing Lamp Posts purchased from you, and find them to be all as you represented. Whilst nearly a dozen of our sixty-five Posts were frozen down last month and first of this not one of yours was affected by the heavy frost. What can you sell them at?

Yours truly,
LUCAS FLATTERY
Sec'y Wooster Gas-Light Co.

Address the Patentee,

J. W. GRAHAM,
Chillicothe, Ohio.

250-9t

GEO. A. McILHENNY'S

PATENT

VACUUM PROCESS,

FOR RELIEVING GAS RETORTS FROM PRESSURE.

Patented in the United States and Great Britain, June 1867 first patent for this purpose in the United States (but not presented to the public until fully tested). Now in successfu operation for six years, with most satisfactory results.

The many devices lately brought to the notice of the American public, to accomplish the same results are mostly old English contrivances tried and abandoned years ago, on account of the machinery, stuffing boxes, valves, levers, etc., necessary

But the extraordinary results obtained by the McIlhenny process, have induced some unprincipled persons to bring to the notice of the public, as *recent inventions of their own*, some of these old devices; their purpose seems to be simply to evade the patent.

This process is not only safe, simple and effective, but costs little to apply. The only machinery necessary is a one and a half inch stop cock, and a half inch stop cock to each bench No alteration in the old system is required. In fact, a Works operated with this process, can at any time be operated on the old pressure system, simply by closing the two stop cocks above mentioned. There is nothing to get out of order, nothing that requires special attention; no stuffing-boxes to pack and keep tight, no valves to keep clear of tar and pitch, no levers to lubricate, and no expense for a great amount of machinery.

The McIlhenny process challenges the world as regards yield and quality of gas.

For particulars apply to GEO. A. McILHENNY, Engineer of the Washington Gas-Light Co., Washington, D. C., or to WILLIAM YORKE, Engineer of the Portland Gas-Light Co., Portland, Me., who will take pleasure in corresponding with any one interested. 807-1y

THOMAS T. TASKER JR. STEPHEN P. M. TASKER.

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PASCAL IRON WORKS, PHILADELPHIA.

TASKER IRON WORKS, NEWCASTLE, DEL.

Office, Fifth and Tasker Streets, Philadelphia.

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FOR GAS WORKS MACHINERY, ADDRESS OFFICE, FIFTH AND TASKER STREETS, PHILADELPHIA.

Manufacturers and Builders of Gas Works, &c., of all Descriptions, of the Most Approved Plans.

WROUGHT IRON ROOF FRAMES.—For Slate, or Corrugated Iron Coverings, with Cast Iron Cornice Gutter. Iron Doors and Frames, Wrought Iron Pivot Blinds, Windows and all kinds of Castings and Smith Work for Buildings.

BENCH CASTINGS.—Retorts, and all Castings and Wrought Iron Work required for Setting them on the Latest Plan. Tar Gates. Wrought Iron Stand Pipes, Retort Lids, Cotter Bars, Coal and Coke Wagons, and Stokers' Tools.

EXHAUSTERS.—Exhausters and Compensators, By-Passes to pass from 4,000 to 150,000 Cubic feet of Gas per hour, with Engines, Governors, Pressure and Vacuum Guages.

SCRUBBERS.—Single or Multitubular Scrubbers, with Self-Acting Pumps for Ammonia Water.

WASHERS.—Cataract and Single and Multitubular Spray Washers.

CONDENSERS.—Single and Multitubular Air and Water Condensers.

PURIFIERS.—For Purifying from 1,000 to 2,000,000 cubic feet capacity daily, with either wet or dry Lime, or Oxide of Iron, and with either Ash Rivetted or Wrought or Cast Iron Lime Sieves.

CARRIAGES.—Movable Lifting Carriages for Purifiers, arranged either for Floor or Overhead use.

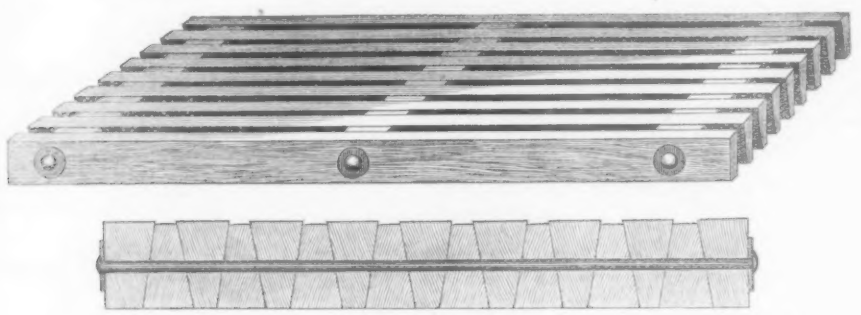
METERS.—Square and Round Meters of any capacity.

GAS HOLDERS.—Single Lift and Telescopic Gasholders, with Cast or Wrought Iron Suspension Frames.

GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes, also Dry Governors with Flexible Diaphragms for Underground Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three inches to forty-eight inches diameter. These Valves are proved on both sides, with a heavy Water Pressure, Flange and Bell Pipes, Fittings and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating Building, and Gas Holder Tanks. Lamp Posts and Lanterns.

P. Munzinger's Patent Ash Lime Trays.



In use at the following Gas-Light Companies:

Pittsburg Gas Company, Pa.
Peoples Gas Company, Baltimore.
Lowell Gas-Light Company, Mass.
Lynn Gas-Light Company, Mass.
Albany Gas-Light Company, N. Y.
Schenectady Gas-Light Company, N. Y.
Utica Gas-Light Comwany, N. Y.
Jersey City Gas Company, N. J.
St. Paul Gas-Light Company, Minn.
Cumberland Gas-Light Company, Md.
Hartford City Gas-Light Company, Conn.
Richmond Gas Company, Va.
McKeesport Gas Company, Pa.
Middletown Gas Company, Pa.
East Newark Gas-Light Company, N. J.
Binghampton Gas Company, N. J.
Zanesville Gas Company, Ohio.

New Orleans Gas Company, La.
Salem Gas-Light Company, Mass.
New Britain Gas-Light Company, Conn.
Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kansas.
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas-Light Company, Ohio.

Augusta Gas-Light Company, Ga.
Huntsville Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York.
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J.
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich.
And numerous other Companies.